13 NOVEMBER 1959

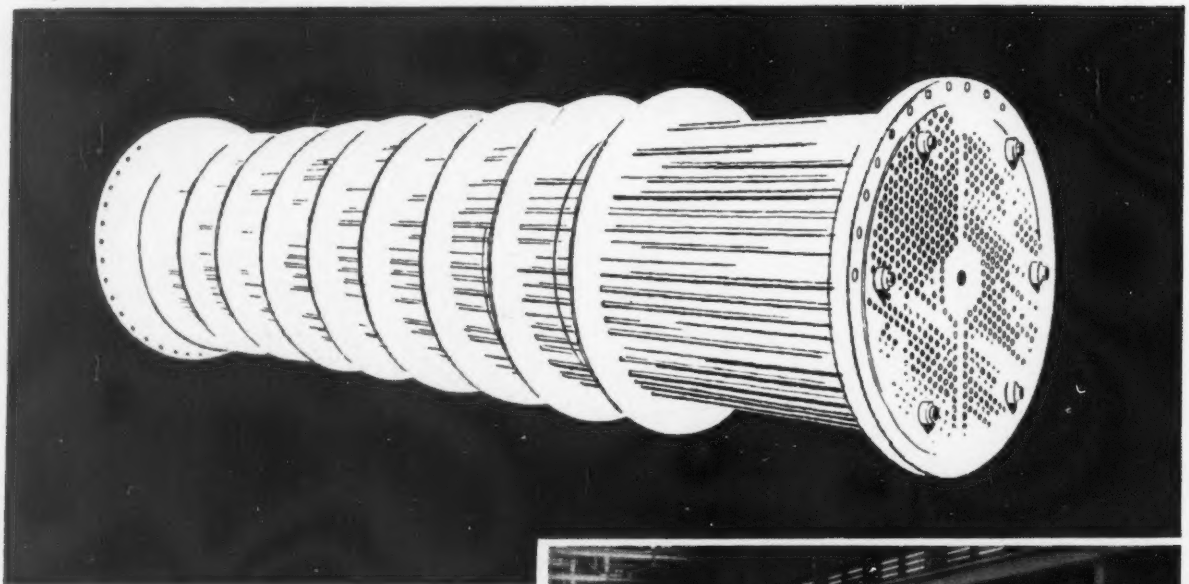
METAL INDUSTRY

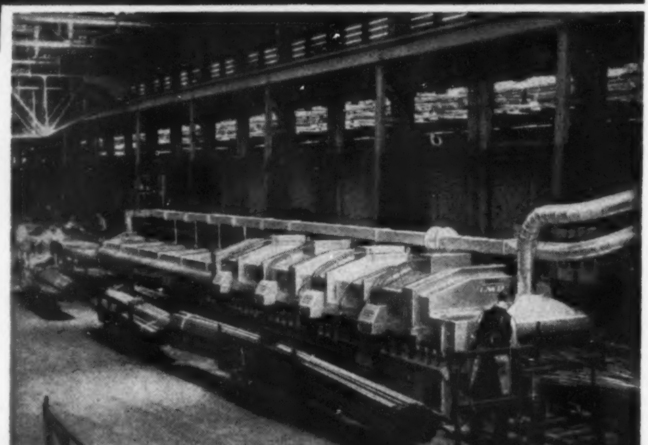
THE JOURNAL OF NON-FERROUS METALS

VOL 95 No 14 ONE SHILLING

The Preston Motorway

SERCK TUBES AND G.W.B.





Above is an artist's impression of a large heat exchanger. The photo on the right shows a Driven Roller Hearth Electrically Heated Furnace supplied by G.W.B. Furnaces Limited to Serck Tubes Limited for annealing a variety of non-ferrous tubes including copper, cupro-nickel and aluminium/brass with or without a protective atmosphere. A large percentage of these tubes is used in the manufacture of Heat Exchange equipment, designed and produced by Serck Radiators Limited, and serving a wide range of applications from oil and water coolers for small internal combustion engines up to large condensers and heat exchangers, such as the type illustrated, for the Petroleum, Marine and Atomic Energy Industries.

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Electrical Aids in Industry *Data Sheet* **No. 8**

Light-Sensitive Cells

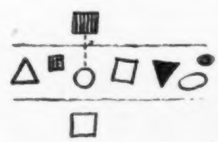
What are light-sensitive cells? They are devices which can sense and measure changes in the level of light or, in some cases, respond to the quality of light falling on them. There are various types of cell and each has its particular field of use. One of the best known is the photo-electric cell.

What can light-sensitive cells do? A change in the amount of light falling on the cell can cause a switch, relay or counter to operate. Alternatively, the direct indication of the light intensity can often allow some other factor to be determined and, if required, controlled. They are reliable and require little maintenance. Careful installation, as with all types of equipment, gives a good reward.

How can they be used? These cells have many applications in industry, for controlling processes, for inspection and measurement, for sorting material and for safety purposes:

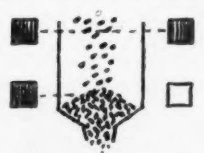
Counting

Where objects on a conveyor belt are too soft or light to operate a direct mechanical counting device, where they are too delicate or freshly painted to sustain physical contact or where the articles vary in size, a light-sensitive cell can be used. This counts the objects by interruption of an appropriately sited beam of light.



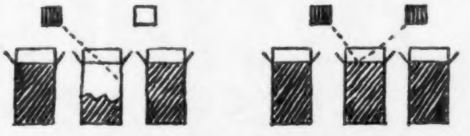
Hopper or Tank Level Control

Many forms of feed can be accurately controlled by light cells. One important one is for controlling the input to a hopper of fluid solids such as sand or peas. Here, two horizontal light beams are required: the upper, when interrupted, indicates that the hopper is full and stops the supply; the lower, when it ceases to be interrupted, indicates that the hopper is nearly empty and restarts the flow.



Package Content

The level of powder in packages can be checked with light cells. The cell is so positioned that when the powder is up to the required level, the light reflected from the surface of the powder is picked up by the cell and causes the carton to be accepted. If not, it is rejected.

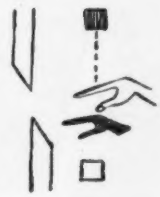


Colour Sorting

The quality of many articles can be gauged by their colour—seeds and nut kernels, for instance. The objects are fed into a tube by means of a vibrator pan and fall into the beams of three equally spaced light cells which scan them from all sides. If the object is acceptable it falls into a chute carrying it to one conveyor; if its colour is bad it is deflected as a reject.

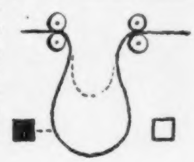
Guillotine Guard

Light cells for guarding a guillotine or power press should be used only as a supplement to a mechanical guard or where the latter is impracticable. The interruption of a curtain of light by a hand stops the machine instantaneously.



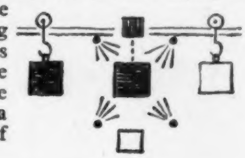
Press Feeding

Where the rate of feed of strip metal must be suited to a varying speed of acceptance by a press, a loop of the strip is allowed to sag between the feed and the press. When the loop reaches a predetermined depth a light beam is interrupted and the slack is taken up.



Processing Objects on the Move

Many articles are processed while on a conveyor line. For instance, where articles are to be sprayed while on the conveyor, the paint saved by stopping the gun between articles will make the device worthwhile. The same principle applies in a bakery to the spraying of baking tins with fat.



Automatic Door Opening and Closing

Doors can be caused to open or close by the interruption of a beam of light. This has its uses in such cases as control of doors on a heating oven or for the passage of vehicles in a factory. This is effected by a light beam on the side from which the approach is made (in many cases, both). When the approach beam is interrupted it opens the door which closes again after a given time interval.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association.

An excellent series of reference books are available (8/6 or 9/- post free) on electricity and productivity — "Higher Productivity" is an example. E.D.A. also have available on free loan a series of films on the industrial uses of electricity. Ask for a catalogue.

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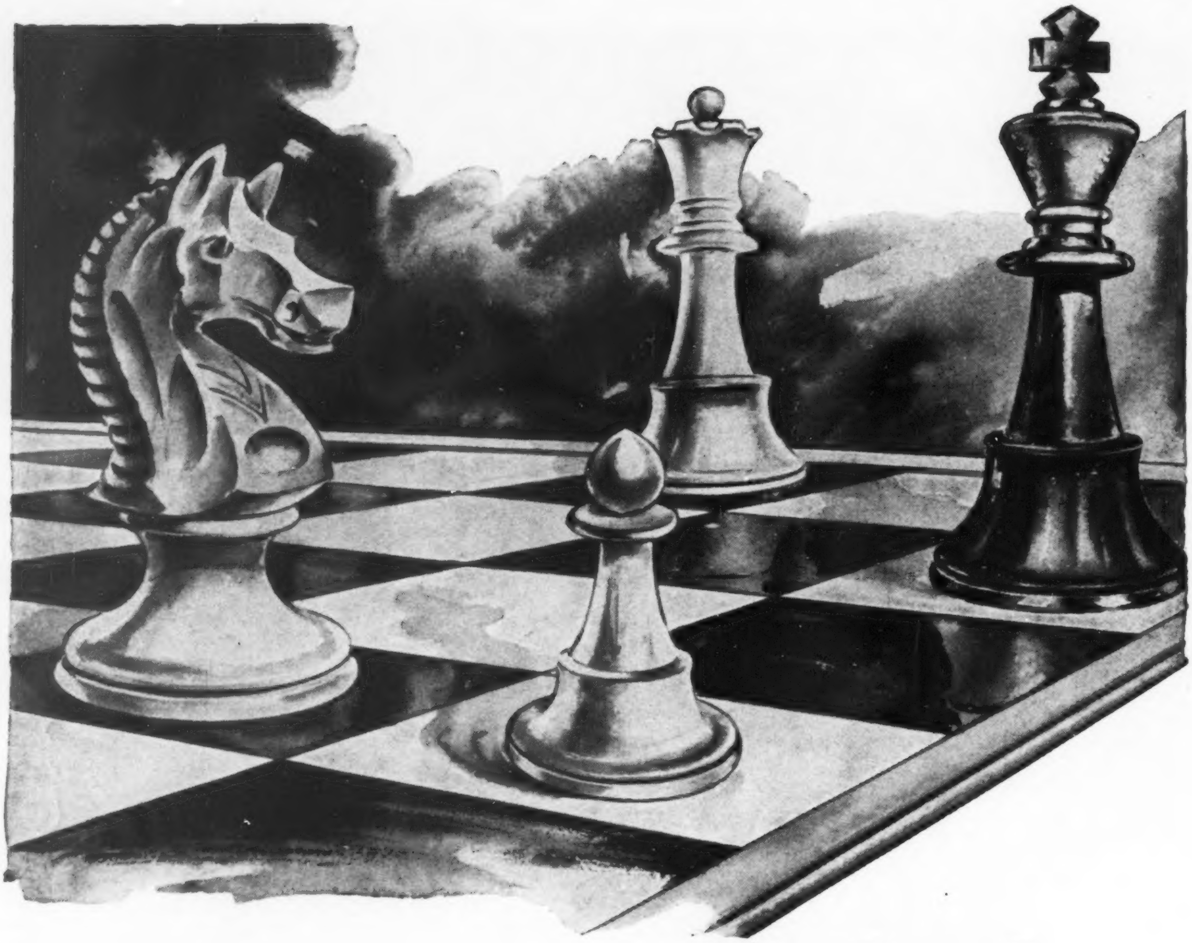

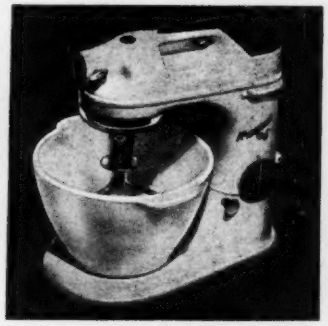

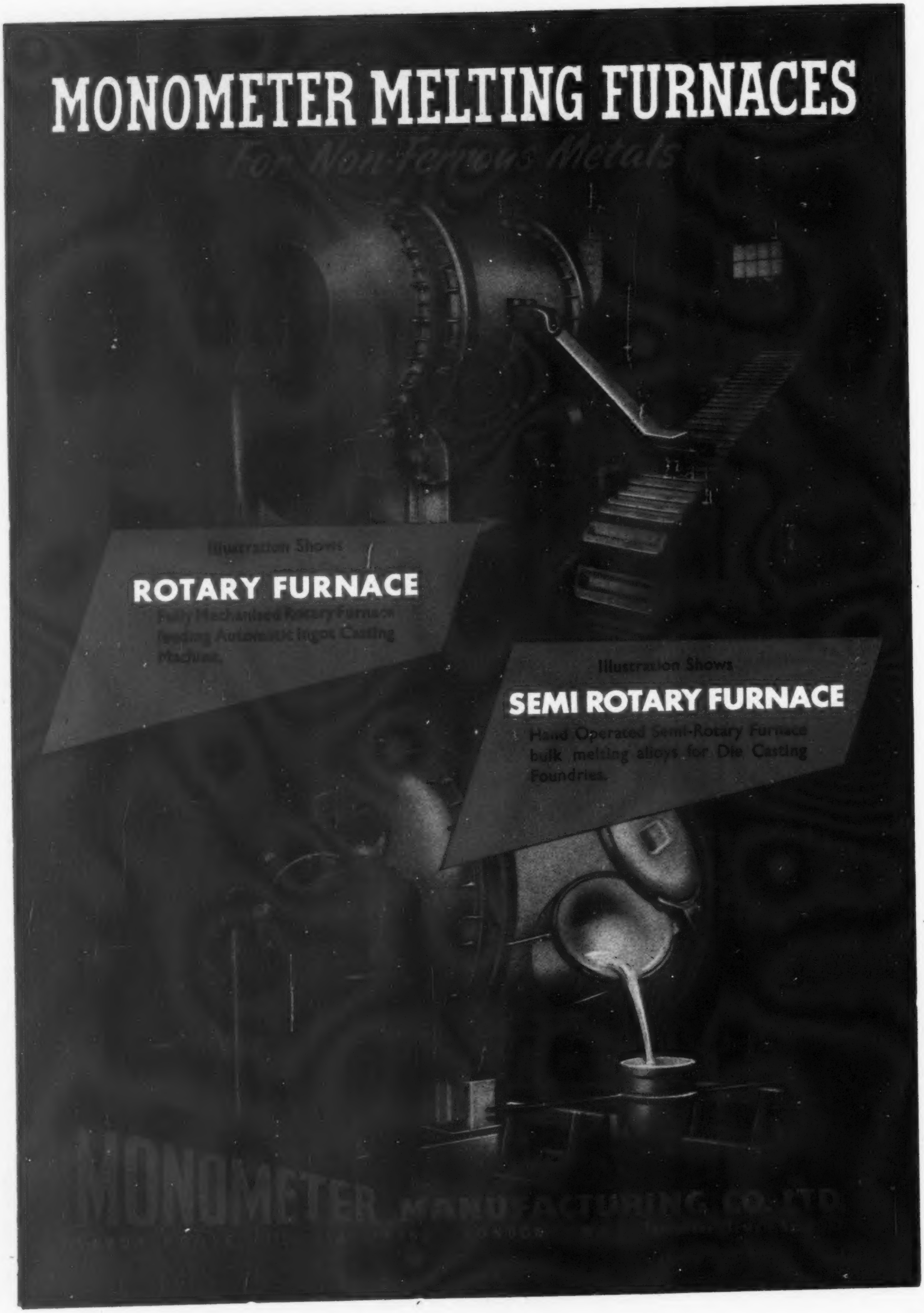
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METAL INDUSTRY

FOUNDED 1909

EDITOR: L. G. BERESFORD, B.Sc., F.I.M.

13 NOVEMBER 1959 VOLUME 95 NUMBER 14

CONTENTS

PUBLISHED EVERY FRIDAY BY ILIFFE & SONS LIMITED

Editorial Offices: 9 Charlotte Street, Birmingham 3 . Telephone: Central 3206

Advertising and Publishing Offices: Dorset House, Stamford Street, London, S.E.1. Tel.: Waterloo 3333. 'Grams: "Metustry, Sedist, London"

Branch Offices: MANCHESTER: 260 DEANSGATE, 3; telephone, Blackfriars 4412 and Deansgate 3595 BIRMINGHAM: KING EDWARD HOUSE, NEW STREET, 2; telephone, Midland 7191. COVENTRY: 8-10 CORPORATION STREET; telephone, Coventry 25210. GLASGOW: 26a RENFIELD STREET, C.2; telephone, Central 1265

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METAL INDUSTRY

VOLUME 95 NUMBER 14 13 NOVEMBER 1959

Technological Education

IN the last few years there has been a remarkable growth in the number of pupils staying on in secondary schools for extended courses of education, and it is expected that the number able to profit from a course of university standard will double within the next six years. At all levels there is renewed emphasis on the importance of mathematics and science. To cope with this growth, the universities have in hand a major expansion programme. The proportion of students reading science and technology, which was 24 per cent in 1939, was nearly 37 per cent in 1957-58 and is expected to exceed 40 per cent by 1970. Nevertheless, the universities at present do not produce much more than half of the scientists and technologists, and however fast they may expand there still remains the need for an alternative route on grounds of quantity alone.

This alternative route is obviously the technical colleges. Anyone who still thinks of the technical college as "night school"—and to their shame even some educationists are among them—would derive great benefit from a study of a Cantor lecture on modern technology and commercial education recently given to the Royal Society of Arts by Mr. A. A. Part, Under-Secretary in charge of Further Education Branch of the Ministry of Education. How many of us, for instance, realize that nowadays more boys who leave grammar schools go to technical colleges than to universities? Or that of those who qualify for professional status every year, one in six of the scientists and two out of every three of the engineers have gained their academic qualifications in a technical college? Or even that about one-third of the boys under eighteen who have left school attend a technical college?

Four main types of college exist. In the local college, part-time and evening work form the bulk of the load up to the level of the Ordinary National Certificate. Higher National Certificates are the aim of area colleges, the work again being mainly part-time. In the regional colleges, full-time and sandwich courses lead to degrees or Diplomas in Technology, while colleges of advanced technology are required to concentrate exclusively on work at undergraduate and post-graduate level. A fifth group, the national colleges, of which there are eight, provides special facilities for advanced studies for industries of national importance which are too small to justify their provision at more than one centre. The essential feature of colleges of advanced technology, which distinguishes them from universities, is their inhibited link with industry, and their success will largely depend on the vigour and skill with which they exploit this.

Perhaps the most obvious fact about British technical education is that so much of it is part-time. Not, indeed, to be compared with pre-war days when the majority of students were in evening courses, since the numbers released in the daytime have risen from 40,000 in 1938 to 400,000 in 1958. The fact remains, however, that despite this welcome increase we are still behind schedule in the efforts to double the numbers released for these courses in 1954-55, and part-time day education is very unequally developed in different industries. Among other causes for disquiet cited by Mr. Part is the fact that there is not nearly enough integration between the technical education given in colleges and the training given in industry. Again, the selection of students for the various courses could be considerably improved and much could be done to improve teaching methods. Future progress depends upon the strengthening of the partnership between the colleges and industry, the formulation of a coherent and up-to-date pattern of colleges and courses, and securing the staff on whom the success of the whole programme of expansion ultimately depends. In these, industry must play its part.

Out of the
MELTING POT

Small Contribution

LIKE so many other narrowly specialized subjects, anodizing of aluminium and its alloys has been studied in such detail that the sum total of the small details has now grown to a formidable size. In spite of the excellence of the documentation on the subject, it is, therefore, not always easy to find out whether or not information on some point of detail is available. Moreover, the number of details being so large, many of them still remain more or less isolated facts with few links between them and many of the other details. The above is equally true of new bits of detail regarding anodizing that from time to time are still being studied and then reported in the literature. Take, for example, a recent bit of information on the effect of adding certain organic compounds to a 20 per cent sulphuric acid anodizing bath. The compounds, added singly in various amounts, were ethyl alcohol, glycerine and aniline hydrosulphate. The addition of organic compounds to a sulphuric acid bath is, of course, not a new idea, although the results claimed as being achieved thereby have always been rather vague. The latest bit of information is to the effect that such additions can reduce the amount of aluminium dissolved during the process of anodizing, and thus enable a thicker film to be obtained in a given time, or a shorter time to be used to produce a given film thickness and, by retarding the build-up of aluminium sulphate in the bath, to prolong the useful life of the bath. Of the compounds studied, ethyl alcohol had very little effect, glycerine was better, and the aniline compound was the most effective: a concentration of 5 gm/L of the compound reduced the concentration of aluminium in the bath reached after 20 min. anodizing from $1{\cdot}457 \times 10^{-3}$ gm/L in pure sulphuric acid to $0{\cdot}745 \times 10^{-3}$ gm/L. The adsorptive capacity of the films for dyes remained unaffected by the addition of the various organic compounds. So much for this particular bit of information. Its probable fate, like that of other contributions before it, in the accumulation of information on the anodizing process, remains, unfortunately, to be regretted.

New Opportunities

ONE disadvantage of the rapid advance of the frontiers of any science is that the distance to be travelled in order to return to even quite recently occupied positions becomes greater and greater. For a change, specialization cannot be blamed for what is almost a geometrical consequence. On the contrary, some degree of specialization and an up-to-the-minute knowledge of the latest developments would be most useful if they could be brought back from, as it were, the front line. Apart from the distance there is, of course, also the question of time. There is so much to do at the front and so little time to do it in, that none of it can be spared for the trip back. As a result, the older interests, problems, methods, processes, techniques, etc., pure and applied, of a science —be it metallurgy or any other—are left behind and neglected. At best, some of them are left to the production people to use and improve if possible, but even the production people, nowadays, are aware that they have to keep abreast of the latest developments and, consequently, are less inclined and have less time to devote to what overnight may become obsolete. Thus, as matters are arranged, it is at present nobody's business to undertake, as a matter of course, the re-examination of the past in the light of the latest achievements: in the light of, for example, the latest materials. How many ideas remained unrealized in the past for want of suitable materials, and how many of those that were realized quite successfully, and have since been abandoned, would have been much more successful had better materials been available? To point out that progress has, in fact, been made, and that to go back would merely lead to its being repeated, assumes that progress could only have been made along one line and, also, that knowing what we know now we would take the same course and do the same as we did twenty years ago; in other words, that there is nothing to be learnt from experience, or should it be that we are incapable of learning from experience? These are rather sweeping assumptions that should be re-examined as a first step to a much neglected past.

Definite Reluctance

IN the circumstances normally obtaining in the cold and hot pressure welding of metals, the hypothesis that the readiness with which metals become welded together depends on the characteristics of the surface films, and in particular on the relation between the mechanical properties of such films and those of the underlying metal, appears reasonably tenable. Substantial surface films of one sort or another are, after all, undoubtedly present. The weakness of this hypothesis, however, is that it leads, in the absence of surface films, to the view that the bonding of perfectly clean metallic surfaces might almost be expected to occur spontaneously, being brought about by the reduction in surface energy achieved as a result of such bonding. That the matter is, however, not quite as simple as that is shown by the evidence provided by some experiments on the bonding of really pure metal surfaces, which was studied over a range of temperatures and pressures. Most of these experiments were done on strips of silver. To make sure that their surfaces were really clean, the strips were degreased with an organic solvent, heated in air at 450°C., cleaned by scraping, annealed for 4 hr. at 850°C. in a vacuum of 2×10^{-5} mm Hg, transferred directly to, and sealed in, aluminium capsules filled with pure argon and containing a strip of copper, and finally heated in the sealed capsules for 5 hr. at 450°C., the copper strip combining with any oxygen evolved from the silver or contained in the argon. The silver strips, while still in the aluminium capsules, were then bonded by pressing between suitable tools at temperatures from −195·8° to 450°C. The results were plotted to show the depth of the indentations against pressure at different temperatures, and also the values of the pressure and temperature at which bonding occurred. The curve showing the latter results, as well as the curves obtained by plotting bonding pressure and bonding deformation (depth of indentation) against temperature, indicate that there exists a definite energy barrier which has to be overcome before bonding will occur. Some experiments with copper specimens having mechanically prepared surfaces showed that the consequent presence of work-hardened surface layers had no effect on the ability of the surfaces to bond.

Skimmer

PROPERTIES — PRESENT KNOWLEDGE — CURRENT WORK — FUTURE OUTLOOK

The "New" Metals

By M. K. McQUILLAN, M.A.

UNTIL relatively recently engineers were content to accept what the metallurgists provided and improvements in design came after improvements in materials. This happy state of affairs ended with the early development of the aircraft industry, and now metallurgists are ever being urged to produce new alloys with improved properties for gas turbine engines, for rockets and many similar applications.

In other fields, too, new demands have arisen, mostly as a result of the coming of nuclear energy. Though already hard-pressed, metallurgical research has been asked to produce materials not only having high strength at elevated temperatures but conforming to the restrictions imposed by such considerations as neutron absorption and behaviour under neutron bombardment.

So far, it has not been possible to control the 60-odd elements which rank as metals sufficiently well to provide something to suit all requirements, but metallurgists are doing their best to co-operate with nature in the production of materials which come nearer to the engineers' desires than those at present available. For this purpose it will be necessary to depend very heavily on a group of metals which, because they have hitherto been relatively little used tend to be known collectively as the "new metals".

Properties

Nearly all the "new metals" which are likely to find more immediate use as structural materials fall within the group known as the Early Transition Elements. Essentially they are the Group IVA, VA and VIA metals of the first, second and third Long Periods. Titanium may be included within the group for the sake of completeness, though it may by now have lost its title to the name new metal. Beryllium (Group II, First Short Period) is the only new metal of any immediate importance lying outside this compact group of elements, though in Groups IIIA and VIIA are to be found the metals scandium, yttrium, lanthanum and rhenium which might prove to have useful properties if their fundamental scarcity could be overcome, and some of the rare earth elements may, perhaps, make a future claim to be included.

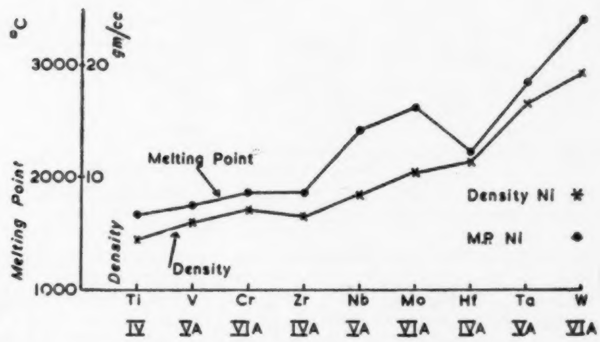


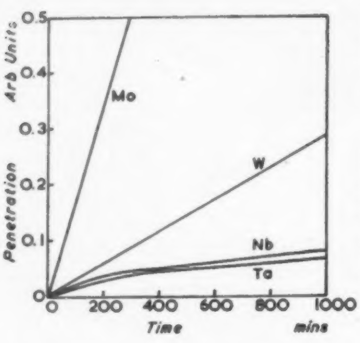
Fig. 1—Densities and melting points

Present interest in the new metals is readily explained by a brief consideration of their properties in relation to current needs, which for the aircraft industry is above all high strength at high temperatures. It is obvious that a high-temperature material must have a high melting point, and this condition is fulfilled by all of the nine transition elements included among the new metals. Some of their melting points are very high indeed, as can be seen in Fig. 1. Low density is another desideratum for aircraft applications, in which strengths are usually compared in terms of the strength to weight ratio rather than absolute strength. Here, beryllium, with a density of only 1·8 would score, but for a high-temperature alloy a melting point above that of beryllium, 1,200°C., would be needed, and obviously some compromise between melting point and density will have to be made. Comparison of the density plot with the melting point plot (Fig. 1) gives an immediate lead as to the elements likely to provide the best melting-point/density combination. For most of the elements considered, melting point and density go hand in hand, but at niobium and molybdenum there is a sudden large increase in melting point without a corresponding density rise. These, therefore, must be considered to be among the metals most likely to provide the basis for future high-temperature materials.

Unfortunately, strength is not the only factor on which the suitability of a high-temperature material depends. Reaction with atmospheric and fuel gases provides another very serious obstacle to the development of new materials for use in modern aero-engines. From this point of view it has to be admitted that the performance of the otherwise favoured group of nine new metals ranges from poor to catastrophic as indicated in Table I. The difficulties are indeed formidable; volatile oxides, liquid oxides, dissolution of oxygen in the metal—all these are encountered, and with the exception of chromium, in no case is a protective oxide scale formed. Oxidation rates of several of the new metals are compared in Fig. 2, and those of niobium and nickel in Fig. 3. The heavy scale formed on a sample of a

TABLE I—OXIDATION BEHAVIOUR OF EARLY TRANSITION METALS

Element	Oxidation Behaviour
Titanium	Dissolves oxygen rapidly at temperatures about 550°C.
Vanadium	Very poor oxidation behaviour owing to formation of low melting point oxide
Chromium	Protective scale formed. Danger of nitrogen embrittlement
Zirconium	Similar to titanium
Niobium	Oxide scale non-protective. Oxygen dissolves in metal.
Molybdenum	Very poor oxidation behaviour owing to formation of volatile oxide
Hafnium	Little information available. Metal severely embrittled by dissolved oxygen
Tantalum	Similar to niobium
Tungsten	Powdery, volatile oxide formed



[Courtesy, "Industrial and Engineering Chemistry"

Fig. 2—Relative oxidation rates for molybdenum, tungsten, niobium, tantalum

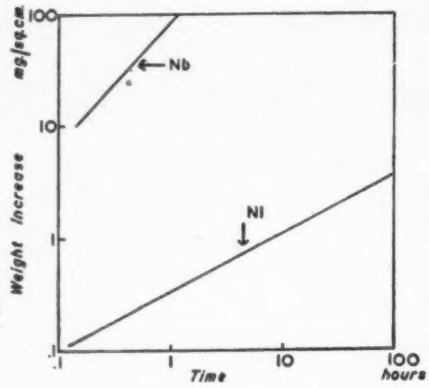


Fig. 3—Oxidation rate of niobium compared with that of nickel

niobium-½ at. per cent chromium alloy after 5¼ hours at 1,000°C. in air is illustrated in Fig. 4. It is evident, therefore, that under the conditions in which they would be required to operate as high-temperature materials, nearly all the new metals in unalloyed form would be useless. From the oxidation point of view, chromium stands out as the most promising, and this fact has justified its inclusion, with niobium and molybdenum, in the small group of metals most likely to become the high-temperature material of the future, even though its melting point and density do not promise so advantageous a strength to weight ratio at operating temperatures as for the other two elements. An additional disadvantage of chromium is that it can be embrittled by very small quantities of nitrogen, which must be avoided during all processing and other operations.

Problems connected with high temperatures also occur in the nuclear energy field. Current plans to operate reactors at higher temperatures will require fuel assemblies and structural components which not only retain adequate strength under neutron bombardment at the new temperature level, but which will also withstand attack by the moderator and the coolant, not merely for several hundred hours, as with aero-engine components, but possibly for years. Other reactor requirements demand that materials used must in general absorb as few neutrons as possible, must not give rise to excessively lethal or long-lived radioactive isotopes under neutron bombardment and must be capable of being fabricated to a variety of special shapes such as very thin-walled tubing.

No metal satisfactorily fulfils all these conditions, and it is customary to start from the least unsatisfactory. The capture cross-sections for neutron absorption listed in Table II make it obvious that neutron absorption will be least for beryllium and zirconium, small for niobium, molybdenum, chromium, vanadium and titanium, fairly large for tantalum and tungsten and very great indeed for hafnium. Beryllium and zirconium are likely, therefore, to be the best metals on which to base reactor materials if they can be made to fulfil the other necessary conditions sufficiently well.

In addition to low neutron absorption, beryllium can offer low density, an appreciably higher melting point than other light metals and hence a wider range of operating temperatures, very good corrosion resistance and an exceptionally high modulus of elasticity. The paramount problem associated with the use of the metal as a reactor material is the great difficulty experienced in fabricating the required shapes due to lack of ductility in directions parallel to the *c*-axis of the crystal associated with the occurrence of slip on only the basal planes of the hexagonal lattice.

Zirconium has generally good corrosion resistance to add to the advantage of its low capture cross-section, and, unlike beryllium, being readily available, it is becoming more and more important as a structural material for nuclear projects. From the manufacturing point of view, zirconium, happily, poses no major problems now that it is treated with due respect in the finely-divided condition, and it has been found, furthermore, that industrial experience with its sister-element titanium can be of the greatest value in handling the newer metal. Some limitations to the usefulness of unalloyed zirconium have given rise to the development of zirconium alloys. These limitations stem from a rapid decline in strength with increasing temperature and from a tendency to catastrophic corrosion in the presence of water at high temperatures, the latter being especially severe when the metal contains dissolved nitrogen. Attack by carbon dioxide at elevated temperatures is another hazard to which zirconium is subject. Alloying, however, has alleviated both major difficulties, and most of the zirconium now required for nuclear purposes is supplied in the form of an alloy containing 1·5 per cent tin, 0·12 per cent iron, 0·05 per cent nickel and 0·1 per cent chromium, known as Zircaloy 2.

Though zirconium is at present the most generally useful nuclear engineering material for applications in which low neutron absorption is important, higher operating temperatures will call for an alternative.

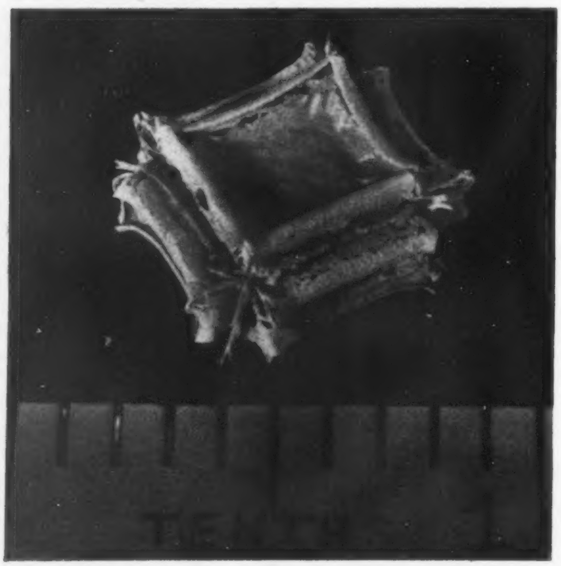


Fig. 4—Oxide scale formed on a sample of niobium-½ at. per cent chromium alloy heated in air for 5¼ hours at 1,000°C.

TABLE II—NEUTRON CAPTURE CROSS-SECTIONS FOR THE NEW METALS

Element	Cross-Section for Thermal Neutron Absorption (barns)
Titanium	5·0
Vanadium	4·5
Chromium	2·5
Zirconium	0·4
Niobium	1·2
Molybdenum	2·6
Hafnium	105·0
Tantalum	20·0
Tungsten	18·0
Beryllium	0·0085

Guided by the capture cross-section list, the next choice falls on niobium. A small amount of this metal has already been used for nuclear purposes, but major advances in the high temperature field will depend on our ability to overcome the basic difficulty of its high reactivity. In the unalloyed condition, niobium will react with pile gases and with many of the materials with which it is likely to come in contact in the reactor at temperatures above 400° to 500°C., and the problem may well be aggravated under neutron bombardment. The high temperature strength of niobium, however, will probably be adequate for most reactor requirements and, when pure, at any rate, the metal is sufficiently ductile to be fabricated into almost any form required. Use of niobium in future reactors, therefore, will be governed largely by the success or otherwise achieved in attempts to reduce the high-temperature reactivity of niobium without destroying its ductility—as indeed is the case for other potential uses of the metal.

Vanadium is another material which the possession of a low capture cross-section for neutron absorption and a high melting point has suggested for use in nuclear engineering, but so far it has found only limited application. Furthermore, for future high temperature requirements vanadium seems unlikely to compete with niobium, since it has the same limitations to an even worse degree, and smaller potential rewards in terms of high-temperature strength. In a similar way, titanium is unlikely to find appreciable uses in the atomic energy field because it can offer little more than zirconium and yet has a higher neutron absorption, though there may be a few special environments in which the corrosion resistance of titanium is sufficiently superior to that of zirconium to justify its use. No atomic energy applications have been suggested for chromium even though it is not a strong neutron absorber, its greatest disadvantage being the considerable risk of embrittlement which would exist under reactor conditions.

If reactors are made so efficient by the use of enriched fuel or by fundamental changes in design, that high rates of neutron absorption can be tolerated, capture cross-section will become a less important criterion of material selection, and under such conditions the really high melting point metals, molybdenum, tantalum and tungsten could theoretically be used. All have been mentioned in connection with nuclear engineering from time to time, but until further progress has been made in reducing their reactivity at elevated temperatures it seems unlikely that they could play a major part in extending the range of reactor operating temperatures.

Among the new metals under consideration, hafnium has by far the greatest power of absorbing neutrons. It is, indeed, among the strongest neutron absorbers available, and could thus be of value when it is desired to slow down nuclear reactions, as for instance in reactor control rods. This point illustrates the errors into which normal chemical ways of thought can lead in the nuclear field. Chemically, hafnium and zirconium are so similar that they always occur together in nature and are very difficult to separate. Yet from the point of view of neutron absorption they are at the opposite ends of the scale, and the greatest care must be taken to reduce the hafnium content of zirconium destined for reactors to no more than a few parts per million.

Though the aircraft and nuclear energy industries are those which make the most severe demands on metals, new developments in other fields are bringing to light a variety of special requirements for new materials. The electronics industry, for instance, is making increasing use of tantalum in electrolytic condensers, for which the thin tenacious tantalum oxide film is especially suitable in having good dielectric characteristics and in being impervious to the electrolyte and self-healing. Other uses for new metals will also appear once the major applications have provided the incentive needed to initiate their development. The chemical industry, for instance, is taking increasing advantage of titanium, which in this particular connection remains a relatively new metal, and is now finding uses for the excellent resistance of niobium, tantalum and molybdenum to attack by various highly corrosive substances, chiefly in the form of linings for large vessels. Small outlets for tantalum and titanium arise in bone surgery, for which purposes they have two valuable characteristics—they are impervious to corrosion by body fluids, and they provide surfaces on to which flesh can grow.

(*To be concluded*)

Ductile Titanium

AN electrolytic process for the production of ductile titanium which also promises greater economy, has been developed at the Norton Company, Worcester, Massachusetts, U.S.A.

In this process, titanium carbide forms the anode of the electrolytic cell. During electrolysis, the titanium is separated from its carbide and adheres to the cathode in the form of fine dendritic crystals of pure titanium metal. Chemical analysis of the crystals indicates a purity of about 99 per cent.

Electrolysis takes place at 900°C., and to avoid reaction between titanium and oxygen and nitrogen an atmosphere of argon must be used to prevent oxidation.

The pilot cell used in these experiments consists of a graphite crucible lined with titanium carbide rings which form the anode. The metal cathode is suspended in the crucible concentric with the anode. The cathode can be retracted into a gas-tight chamber above the cell. This chamber, which is also argon filled, serves as a cooling chamber as well as an "air lock" through which the batch is removed. Fresh cathode bars can be inserted into the cell for semi-continuous operation until all the titanium in the anode has been depleted. The experimental cell made batches of up to 12 lb.

Direct current is applied to the cell at 4 V, 800-1,000 amp. Power consumption is 8-10 kWh/lb. of titanium produced. After the titanium has been extracted from the titanium carbide anodes, a skeletal structure of carbon remains. This is rigid enough to be removed in one piece from the crucible. A design based on the removal and replacement of the used anode with a fresh one would make continuous operation possible.

When washed to remove the electrolyte, the crystals of titanium can be used with any of the present-day techniques for fabricating titanium sponge. The crystals may readily be used in powder metallurgy processes. Compacts of the powder have been sintered to form ductile, dense bars superior to other titanium powders tested.

The titanium metal crystals which are produced in this electrolytic process are clean melting and safe to work with. They have no tendency to be pyrophoric under normal conditions.

Although the laboratory cells used in developing this process were not large enough to establish reliable cost estimates for actual production equipment, it appears that titanium could be produced economically in this way.

One reason for this is the relatively inexpensive titanium carbide which is the raw material for the process. Titanium carbide, already commercially available, contains about 80 per cent titanium. Titanium carbide can be made from ilmenite, which is relatively inexpensive.

Present commercial processes use titanium tetrachloride as a starting material. Although the price per pound is comparable to titanium carbide, the latter contains about three times as much titanium.

In addition to making titanium, the Norton electrolytic process is also designed to produce niobium, vanadium, chromium, zirconium, tantalum, hafnium, molybdenum, thorium and tungsten.

Obituary

Mr. L. I. Shaw

WE regret to record the death of Mr. Leonard Isaac Shaw, chairman and managing director of B. Mason and Sons Ltd., metal merchants, of Wharf Street, Aston, Birmingham. He was also chairman of Isaac Shaw Ltd.

"Oriana's" Aluminium Superstructure

All-welded aluminium deckhouse structure of the new Orient Line vessel "Oriana," in course of construction by Vickers-Armstrongs (Shipbuilders) Ltd., Barrow

BY adopting welded aluminium fabrication for the whole of the superstructure above the strength deck of the new Orient Line vessel *Oriana*, enough weight has been saved to allow passenger accommodation to be increased to the extent of a complete deck, without reducing stability. In the eight tiers of deckhouses, three of which extend the full 450 ft. length of the superstructure, 1,000 tons of aluminium plate and sections were used, about 870 tons being supplied by Northern Aluminium Company Ltd.

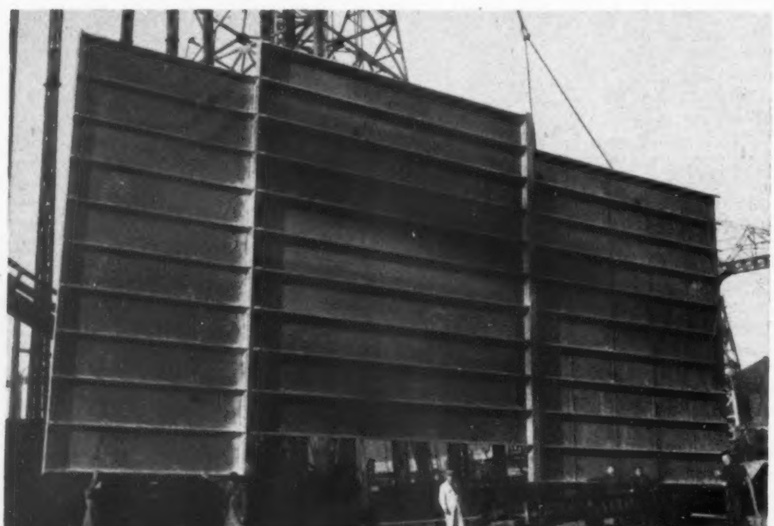
Welding

Planning for the use of aluminium on this scale necessarily began several years ago, and preliminary investigations to settle such questions as the best welding procedures and techniques to be adopted were undertaken in 1955. In that year a large experimental deck panel was constructed in co-operation between the shipbuilders, Vickers-Armstrongs (Shipbuilders) Ltd., and Northern Aluminium Company. The general method of construction used for the panel was to join the plates by butt welds laid on to permanent backing bars wherever possible. Though at that time experience of welded aluminium deckhouse construction was, of course, not so extensive as it is now, this system had already been successfully used for other ships, and it was eventually adopted for the *Oriana*.

The welding itself was carried out using consumable-electrode argon-shielded-arc equipment. The widespread use of welding as a means of fabricating aluminium structures is comparatively recent, but the modern fluxless processes of this type are now thoroughly established and have brought the same ease of construction in aluminium that the shipbuilder is accustomed to find with steel.

Among the items of aluminium welding equipment used by Vickers-Armstrongs for work in the *Oriana* was a Quasi-Arc gantry type of machine (capable of Sigma welding of aluminium and Fusarc welding of steel) for fillet welding; Quasi-Arc tractor-mounted equipment for butt welding both in the shop and aboard the ship; and Quasi-Arc/B.O.C. Lynx sets for manually-operated assembly welding.

Preliminary investigation work to assess the best welding procedures and techniques for the aluminium superstructure of the "Oriana" included the construction of this experimental deck panel, built in 1955 in co-operation between Vickers-Armstrongs (Shipbuilders) Ltd. and Northern Aluminium Company Limited



Construction

Prefabrication was adopted as an essential technique in the building of the aluminium superstructure. Deck panels, with a typical size of 25 ft^2 and weighing about two tons, were built up as units, and several larger structures, such as internal stairways, were also fabricated and lifted aboard complete.

As with a steel ship's structure, it is an advantage to use aluminium plates of the largest available size. Until recently, designers have tended to be hampered by the fact that at present there is no hot mill at work in this country capable of supplying aluminium plates in widths greater than about 7 ft. To overcome this problem until their new wide rolling mill comes into operation next year, Northern Aluminium Company have supplied for the *Oriana* and other applications Noral "Welded Plate". This is aluminium alloy plate of up to 11 ft. wide, produced by the automatic welding together of two plates edge-to-edge in a special jig. The weld bead on the resulting composite plate can, if desired, be ground flush, on both sides if necessary, making the finished plate comparable in appearance with ordinary rolled material. The quality of the welding, moreover, is such that for most purposes not involving forming the presence of the weld need hardly be considered.

To ensure flatness, many of the pieces of Noral welded plate supplied for the *Oriana* were stretched after welding, using a 4,000 ton stretcher recently installed at Northern

(*Continued on page* 306)

DISPOSITION OF CAVITIES AND CORES FOR FLANGED COMPONENTS

Design of Die-Castings

By H. K. BARTON

XI—Conversion from Bar Stock

(Concluded from METAL INDUSTRY, 6 *November* 1959)

AXIAL sections such as that of Fig. 1b (see page 283) represent a very common type of screw-machine part; because the stock size is determined by the flange diameter, the metal wastage is high. Even on this count alone, therefore, conversion to die-casting may be an economic proposition. Many such parts, however, embody features which call for rather elaborate sequences if produced by machining, but which are very easily die-cast. Machining is easiest when continuous concentric surfaces are in question, and features calling for surfaces which are either uninterrupted but not concentric with the stock axis, or are concentric but not continuous, invariably add considerably to the part cost. Die-castings, by contrast, can incorporate the most irregular forms, provided they do not form undercuts, without any reduction in the rate of production.

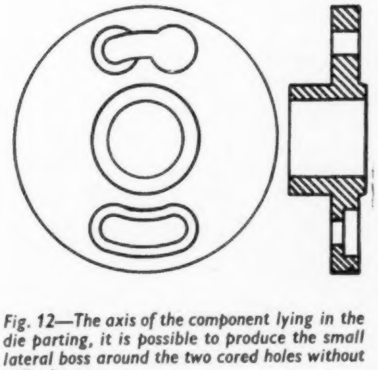
A good example of this is the bayonet-lock on the component of Fig. 10, top, which allows the flange to be dropped into place over a pair of loosely-assembled cap-screws. These project through the larger portion of the keyhole slots, and by turning the flange anticlockwise are brought into line with the counterbored seatings. When the cap-screws are tightened, the heads enter the seatings and prevent rotation of the flange. Both this feature, and the similar though simpler arcuate slot allowing angular adjustment of the flange with regard to a fixing screw, which is illustrated in the lower part of the figure, are expensive to produce by machining but add negligibly to the cost of a die-casting.

The simplest way of casting flanged components such as these is to form the flange in the plane of the die-parting—in most cases sinking the flange cavity wholly within the fixed die member as in Fig. 11—and to form the axial hole with a fixed core normal to the parting plane. For this to be possible, the component must be free from annular grooves, lateral cored holes or other features causing undercuts. These include cast external threads, which necessitate unscrewing the casting from the cavity if the axis of the piece is disposed as in Fig. 11. Nevertheless, it is so much faster and cheaper to produce flanged pieces this way that the cost of machining a screw-thread often leaves the die-casting the more economical product.

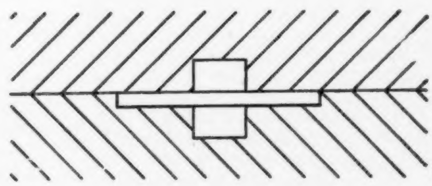
If the component has transverse holes it must necessarily be cast with its axis in the die-parting, and this allows a great deal of freedom in the formation of features which, with the disposition of Fig. 11, would constitute undercuts. Cast threads—termed "split" threads—are frequently so formed, and it is possible also to modify the shape, where necessary, to strengthen what in a repetition-machined component would be weak sections. Thus a small boss around the two lateral holes in a thin circular wall (Fig. 12) appreciably increases the strength and provides twice the tapping length possible with the plain circular wall of the machined part, even though the latter has a slightly greater thickness.

Before designing components with features necessitating this disposition, nevertheless, it is essential to realize the limitations which it imposes. The flange, for example, cannot have cored fixing holes in it; nor will it be perfectly circular in outline. More important, in many applications, is the fact that both faces of the flange are interrupted by the joint-line, from which flash must be trimmed. A high degree of planarity cannot be looked for on either face. If, therefore, the flange must bed down snugly at assembly, it is necessary to face off the draft (Fig. 13) in a separate operation after trimming.

This is a straightforward operation which die-casters regularly carry out on such components, but it may, nevertheless be worth considering the



Left : Fig. 10—Slots for locking (top) and adjustment are characteristic of details which are very easy to die-cast but difficult and expensive to machine



Right : Fig. 11—The simplest cavity disposition for flanged die-castings

Fig. 12—The axis of the component lying in the die parting, it is possible to produce the small lateral boss around the two cored holes without difficulty

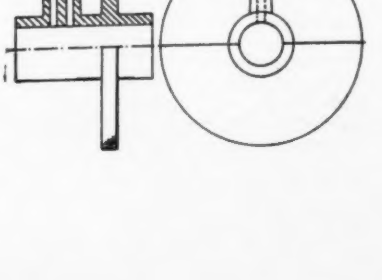


Fig. 13—With the axis in the parting plane, neither face of the flange can be perfectly plane

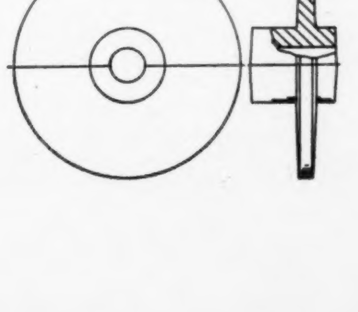
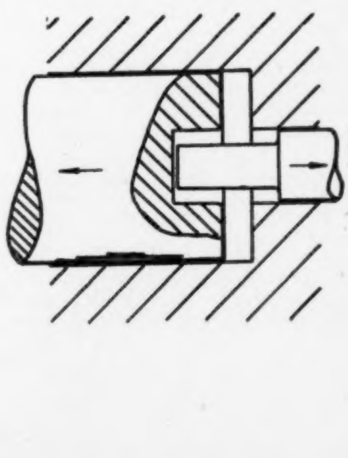


Fig. 14—The moving core on the left, of full diameter, produces a flat face on the flange



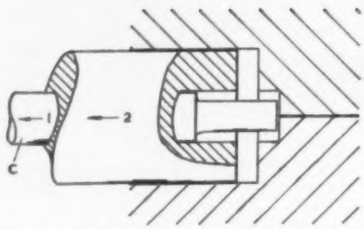


Fig. 15—An alternative die construction which similarly achieves planarity of one face

alternative of forming one face of the flange by means of a moving core. This both allows a general planarity of the surface to be maintained, and permits the casting of holes and recesses normal to the plane face. Such a disposition is illustrated in Fig. 14, from which it will be noted that the internal bore is formed by a moving core axially opposed to that forming the flange. The presence in a die of two sets of opposed cores rather cramps the style of the tool designer, for he is left with little choice of sprue and runner location. Because of this, the method is only used, for the most part, with components having flanges two or three inches in diameter and, thus, warranting production in a die with only two impressions.

If a flat flange-face is required on smaller parts it is desirable to core from one end only, and this can be achieved by providing a generous external taper on one spigot so that it can be formed within the main core. Below the flange, the component is grooved or otherwise restrained so that it cannot lift as the core retracts. This is the simpler alternative, but if the die-caster considers that the casting may be unduly stressed during core withdrawal, he is likely to adopt a two-stage core-withdrawal. This entails pulling the central core *c* (Fig. 15) while the main core is still holding the casting in place within the die, which eliminates the possibility of the spigot fracturing where it joins the flange and lifting with the core.

The component sketched in Fig 1 *c* may be taken as representative of a large class of repetition-machined parts which, if converted to die-castings, must be produced with one particular set of core orientations that can only be modified by major changes in the form of the part. It is evident from the sketch that the long axis of the piece must lie in the parting plane, since the left-hand spigot cannot be withdrawn axially from the die. Similarly, the pronounced taper on the large transverse hole entails its formation by a single core mounted, preferably, in the ejector half of the die. The disposition of the cavity and cores is thus fixed in all respects, and the limitations upon the external features are as already outlined.

A point to be borne in mind in all conversions from repetition-machined parts is that the die-casting is by no means restricted to holes and recesses of circular form, as was the part which it is replacing. It is just as easy to cast a half- or threequarter-round hole as a full circular one, and such modifications can often appreciably simplify assembly. This also applies to splined and polygonal holes. It can be assumed, in fact, that virtually any simple section (i.e., one bounded by a single unbroken line) that can be extruded can also be formed in negative by a core. This makes it very easy to combine die-castings and extruded sections in a single assembly, since the parts can be secured either rigidly or slidably without the use of extraneous fixing devices.

It will, no doubt, be clear from the foregoing that the more detailed and intricate the shape of a screw-machine part, the greater is the likelihood that, for large quantities, die-casting offers a possibly more economic means of production. It is true that of recent years a fair number of quite simple pieces—nuts, washers, spacing collars—which one thinks of as being pre-eminently suited to production from stock rod have, in fact, been turned over to die-casting with an appreciable saving. These pieces are, nevertheless, too simple to take full advantage of die-casting; indeed, some of them are already being converted again, this time to the fractionally more productive process of powder metallurgy.

Men and Metals

Owing to continued ill health, **Mr. H. C. Clements** has resigned from the board of W. Canning and Company Limited and terminated his executive position with the company. For nearly forty years Mr. Clements has been associated with the company's engineering division and played an important part in its development.

It is announced that **Mr. Herbert Slack** has been appointed to the board of Kelvin and Hughes (Industrial) Limited, as sales director. He was formerly technical sales manager and joined the company in 1949. In 1955 he took over the industrial sales organization of the company in the North of England and Scotland, in addition to the technical contracts department. Shortly after the new headquarters of the company were established at Wembley, Mr. Slack moved there from Scotland.

News from F and M Supplies Limited is to the effect that **Mr. F. W. Nield,** technical development manager, **Mr. D. Epstein,** chief chemist, and **Mr. Michael Danischewsky,** works superintendent, have been elected to the board of the company.

Formerly vice-chairman, **Dr. Robert Hunter,** deputy managing director of The Clyde Alloy Steel Co. Ltd., has been elected chairman of the Council of the British Steel Castings Research Association. **Mr. W. S. Scott,** a director of Darlington Forge Limited, has been elected vice-chairman of the Council.

An announcement from the British Valve Manufacturers' Association states that **Mr. F. Burgess** (Whites-Nunan Ltd.) has been elected chairman of the association for the year 1959-60. The immediate past-chairman, **Mr. J. W. Plowman** (Dewrance and Company Limited), has been elected vice-chairman.

In succession to **Dr. Maurice Cook,** C.B.E., who retires from office at the end of this year, **Mr. F. C. Braby,** M.C., D.L., M.I.Mech.E. (chairman and managing director of Fredk. Braby and Company Limited), has been elected chairman of the Council of the British Non-Ferrous Metals Research Association. Mr. Braby has played an active part in the affairs of the association since 1929, and has been a member of the Council since 1935. In 1950 he was appointed a vice-chairman and honorary treasurer of the association.

It is learned from Suckling and Thomas Limited, of Birmingham, that **Mr. Peter G. Suckling,** M.A., has been appointed a director of the company. Mr. Suckling joined the company in 1950. He was educated at Solihull School and took an Honours degree in Science and Metallurgy at Cambridge University.

The newly-created post of Scientific Adviser to the U.K. High Commissioner in New Delhi has been filled by the appointment of **Dr. H. R. Ambler,** O.B.E., F.R.I.C. In addition to advising the High Commissioner on scientific matters, he will be responsible for furthering the exchange of information between British and Indian scientists. Dr. Amblar will hold the rank of Senior Principal Scientific Officer in the Department of Scientific and Industrial Research. At present, Dr. Ambler is Assistant Director of the Ministry of Supply's Chemical Inspectorate at Woolwich.

To succeed the late Mr. W. E. Chamberlain as chairman of the Chamberlain Group of Companies, **Mr. Leslie F. Chamberlain** has been appointed.

It is understood that **Sir Walter Worboys** has resigned from the board of Imperial Chemical Industries Limited.

In succession to **Mr. W. B. Cleverley,** managing director of the Carborundum Company, who is to retire from the board at the end of this year, **Mr. G. R. McKenzie** has been appointed. **Mr. T. G. G. Peterson** has been appointed to succeed Mr. McKenzie as controller.

Reviews of the Month

NEW BOOKS AND THEIR AUTHORS

METAL PHYSICS

"Progress in Metal Physics." *Volume* 7. *Edited by Bruce Chalmers. Published by Pergamon Press Ltd.*, 4-5 *Fitzroy Sq., London, W.*1. *Pp.* viii + 408. *Price* 110*s.* 0*d.*

IN reviewing this volume, a complaint must first be made. The book is sold in a paper dust-cover on which is printed what purports to be a laudatory review notice from "Nature" reading: "This is a good, wholesome volume . . . and a welcome addition to the sequence." Actually, the sentence comes from a review notice of Volume 6 of the series, and this method of advertising must be strongly condemned.

The continual advances in metallurgical science necessitate the publication of review articles, and all metallurgists must be grateful to those who devote their time and care to this kind of work. To the present writer, it seems that two distinct kinds of reviews are needed, and it is a defect of the present series that these two needs are not kept more distinct. On the one hand, some readers require an account of the real progress which has been made in some branch of the science, and of the underlying principles. For this purpose, a Paper of 20-30 pages is sufficient, and the authors must select what is important to illustrate the general principles, and must discard much good work in order to avoid clogging up the reader's mind. Other readers require a complete summary of recent work on a subject, with full references to all published Papers. A review of this kind is of great value to those engaged on a particular subject (or on some closely allied branch of science), but the reader seeking general knowledge will usually have to write his own summarized version, unless the review article is itself interspersed with summaries which greatly add to its length.

The present volume begins with a Paper (64 pages) by J. N. Hobstetter on "Equilibrium, Diffusion, and Imperfections in Semi-conductors." This is clear and interesting, and can be readily followed by the general reader —it contains a little too much that is still uncertain.

The next Paper, "The Physical Metallurgy of Titanium Alloys" by R. I. Jaffee, occupies 98 pages, and is less successful. The first 34 pages are mainly a description of the equilibrium diagram of binary titanium systems, and are little but a duplication of what has appeared in Hansen's textbook—little attempt seems to have been made to include later work, and in the case of Ti-Ni, Hansen is more up-to-date. This is followed by a section on plastic deformation of titanium and its alloys, of which the later parts are clear and well-written. Concluding sections deal with beta-stabilizing, alpha-stabilizing, and alpha-beta alloys.

The third Paper, "Thermodynamics and Kinetics of Martensitic Transformations" by L. Kaufman and M. Cohen occupies 81 pages. At the beginning, more than four pages are required in order to list the symbols used in the Paper, and much unnecessary trouble is caused by the fact that these are not set out in alphabetical order. Much useful information is contained but, to the reviewer, the Paper is too much a summary of rival views, and too little an account of real progress.

The fourth Paper, "The Stored Energy of Cold Work" by A. L. Titchener and M. B. Bever, occupies 91 pages. Some parts are of great general interest, but in many places considerable abbreviation could have been made without any real loss.

The final Paper, "The Properties of Metals at Low Temperatures" by H. M. Rosenberg, occupies 55 pages and is extremely well written and most interesting. The properties dealt with are thermal conductivity, mechanical properties at low temperatures, creep and fatigue at very low temperatures, electrical conductivity, and specific heat. Dr. Rosenberg shows an uncommon power of selecting and summarizing what is important for his purpose and, for the reader seeking general information, his Paper is admirable.

W. H.-R.

FOUNDRY PRACTICE

"Handbuch der Geisserei-Technik" ("A Manual of Foundry Technique"). *Vol.* 1, *Part* 1. *Edited by F. Roll. Published by Springer-Verlag Heidelberger Platz* 3, *Berlin-Wilmersdorf. Pp.* 892. *Price DM.* 136.

THIS manual appears to be planned on a monumental scale. There will be four volumes, and the present one, actually being only the first half of Volume 1, is a substantial quarto affair of 892 pages (and correspondingly expensive). The contents of the further volumes will be:—Volume 1, 2nd Part: Materials, Part 2; Volume 2, The Technique of Mould Production; Volume 3, Melting Furnaces, Blending, Technique of Annealing and Heat Treatment of Malleable Castings; Volume 4, Technology of Plant and Transport Equipment, Layout, Power Economy, Health and Accidents, Shop Management, Patents, Training and Education.

The volume to be reviewed here comprises 17 sections written by a number of authors, generally specialists in the field they are dealing with.

The first section stands a little apart from the remainder as it is the only one venturing into general theory. Professor E. Scheil gives a very concise and balanced but still—in view of the condensed treatment and the difficulty of the subject—surprisingly readable account of the present state of the theory of casting. He starts with a short description of the present views concerning the theory of the liquid state and describes the fundamental facts, properties and reactions of liquid and solid metals which govern the filling of the mould and the development of the cast structure.

The following sections on various types of iron castings, namely Cast Steel (W. Trommer), Malleable Castings (K. Roesch and O. Klein), Art Castings (P. Lipp), are technological in the more restricted sense, in that they are written mainly for the worker in the field, giving the state of the art in an up-to-date manner with many diagrams, tables and illustrations, and a wealth of literature references.

As an illustration, the section dealing with Cast Steel comprises 82 pages, 108 illustrations and diagrams, 42 tables and 346 references. The sections on Malleable Castings and Art Castings are smaller but still quite detailed. Metallurgy, methods of production, properties and specifications for different applications are covered.

After the sections introducing these three kinds of iron castings (grey cast iron and white cast iron will be treated in the 2nd Part of Volume 1 to be issued shortly) there follow two very detailed sections dealing with raw materials, both written by the Editor (230 pages). Pig iron and alloying additions, fuel, refractory materials, mould materials and a large number of accessory materials down to putty for patterns and protective paints are covered. As an appendix to this chapter, a further 30 pages contain a survey of special testing methods for moulding sands and core binders by F. Hofman and W. Goetz.

The section on Chemical Analysis (100 pages) is contributed by the late H. Pinsl, a well-known analyst, and L. Pinsl (probably his son). Spectro-analysis is given a separate chapter of 40 pages (O. Werner).

Sections on mechanical testing (70 pp. W. Bischof)—including the production of test bars—and metallography (D. D. Ammann and M. Krichel, 30 pp.) conclude the part dealing with testing methods.

The following 60 pages are devoted to a great variety of surface treatment (A. Hoch, with a separate chapter on enamelling by A. Kraeutle) from galvanizing to paint.

The last section (35 pages) comprises three contributions on the welding of ferrous castings (cast iron, C. Stieler, cast steel, W. Trommer, malleable castings, F. Roll). To the

reviewer, this section appears short compared with the scale of some of the other parts of the book.

In the preface, the Editor states that the manual is intended to carry on the tradition created by the famous work by C. Geiger, "Handbuch der Eisen u. Stahlgiesserei", the last edition of which appeared in 1931. The technology and science of casting has been developing very rapidly since that time. The intention of the Editor, then, is to give an up-to-date review of the position, screening and evaluating the vast literature, and to supply a limited number of literature references for more detailed information.

In the reviewer's opinion, the intentions of the Editor have been ably covered by the various contributors. Only the arrangement of the various sections seems a little arbitrary, e.g., one would have expected the chapter on grey cast iron and white cast iron to follow immediately after the ones on other kinds of ferrous castings, and the sections on surface treatment and welding seem to be unconnected with the other parts of the volume. They would probably be better allocated to Volume 3. This is not a work for the generally interested outsider. The arrangement is mostly strictly for the convenience of the worker in the field who wants to find certain information quickly, and not for easy reading. The treatment is often austere, even a little monotonous, as can be expected considering the vast amount of detail to be covered. But these apparent disadvantages are probably unavoidable in a book of this nature. The production, printing and illustrations are up to the high standard of the house of Springer. The reviewer cannot help indulging the malicious pleasure of reporting that he has "found out" this famous publisher with an error. On page 30, the captions of Figs. 29 and 30 are exchanged.

E. S.

ELECTROPLATING

"Control in Electroplating." *Published by Robert Draper Ltd., Kerbihan House, 85 Udney Park Road, Teddington, Middlesex. Pp. ix+92. Price 15s. 0d.*

MOST technical books come under one of two headings; they are either student text books or reference books for the qualified technician. This book can hardly be said to come under either of these headings. It cannot be classified as a reference book, as, being a verbatim report on a symposium, it has no index, and it cannot be classified as a students' text book, as it contains so much matter which is merely opinions of the people taking part in the discussions.

It contains little new material, and the only positive contribution is Mr. Langford's suggestion on the formation of a standing committee to consider new analytical techniques relating to electroplating materials.

The Paper by Such is an excellent review of methods of physical testing, but, by the very nature of the Paper and therefore of this book, the descriptions given are extremely sparse. The chapter on available references regarding physical testing methods is useful.

Mr. Corfe's Paper on "trouble shooting" appears to make plating processes extremely simple, and to a large extent would seem to duplicate the supply house and books and technical working instructions. The Paper implies that plating troubles are easily sorted out, rather like a cookery book, but any practical plater could tell a rather different story. The tables for Hull cell behaviour for different solutions could be useful to the electroplating chemist, but again the emphasis is on simplicity and the ability to reproduce Hull cell characteristics is not always so straightforward.

There was much repetition of the obvious in Langford's Paper, e.g., the need for frequent analysis to prevent rather than overcome plating problems, elementary precautions in sampling, the chemist's position in the plating shop, etc.

The Paper gives nothing new, and a publication of this nature is not needed to tell the chemist the difference between volumetric and gravimetric analytical procedure, and does anyone but a chemist wish to know?

The Paper by Smith on Metal Finishes for Services Equipment contains little new, or of interest, except for the accelerated thickness test for cadmium deposits.

The same remarks might apply to the discussions, where comments emphasizing the obvious are all too frequent. The "need for frankness between chemist and foremen platers, leading to better co-operation" is only too obvious to anyone in the industry and comments such as these do not need a book to emphasize them.

In general, the symposium may have served a useful purpose in providing a meeting for members of the industry to voice opinions and exchange ideas, but one cannot recommend the expenditure of fifteen shillings for a book of this nature.

F. W.

Process Heating

AN induction heater, the R.F.2, with medium impedance output and providing a continuous output of 1·5 kW at 2 Mc/s has been designed for bench operation by Pye Ltd., 28 James Street, Cambridge.

The heater is housed in an aluminium cubicle and finished in green-grey hammertone enamel, with safety switches on the removable sides, the overall dimensions are 24⅛ in. high, 17½ in. wide, and 21¼ in. deep. The equipment is self-contained, with its own automatic resetting process timer, overload relay to protect the valves, and water pressure switch to protect the equipment.

In this unit, provision is made for remote control, and a pulse is available at the end of the heating cycle to initiate a quench or any other operation required. The equipment is designed to be operated from a single-phase supply, 180-250 V, 50 c/s, with a full load consumption of 3·1 kW.

Bench induction heater, type R.F.2, made by Pye Limited

STANDARD SPECIFICATIONS

Soft Solders (B.S. 219: 1959). Price 4s. each.

REQUIREMENTS for the ten grades of soft solder for general use specified in the 1949 edition are included in this revised publication, together with requirements for four additional solders—"N" and "H" which had been included in an earlier edition of the standard, "V" which is identical with a solder specified in B.S. 441, "Rosin Cored Solder Wire", and "R", a non-antimonial version of solder "M".

Requirements relating to three solders for service at higher temperatures, which were previously referred to in an Appendix, now appear in Section Three of the standard. These solders have been designated by their maximum tin content, followed by a letter indicating the major alloying element, to distinguish them from the solders for general use, which are designated by letters as in the earlier edition.

Copies of the above-mentioned standard may be obtained from the British Standards Institution, 2 Park Street, London, W.1.

EXTENDED FACILITIES AT ERITH FOR GENERAL ELECTRIC COMPANY LTD.

Mineral Dressing Laboratory

FOR some time, ever-increasing demands on space at the Wembley research laboratories of the General Electric Company Ltd., coupled with the re-organization of the Mining Department at Erith, have given rise to serious consideration of the position of the mineral dressing laboratory, which had been part of the research laboratories at Wembley since 1930. It was eventually decided that there was much to be gained by a move to Erith, especially as many valuable facilities of the Wembley laboratories, including analytical services and X-ray diffraction for the identification of minerals, would still be available. The closer co-operation that would be possible with the engineering and sales departments at Erith was a major consideration in making this decision, since one of the primary objects of maintaining the laboratory is, of course, to promote sales of mining machinery.

Advantage has been taken of this move to add to and expand the range of the laboratory equipment which now covers an even wider field than before. The new facilities are believed to be the most comprehensive of their type in this country.

Functions

The investigations of a mineral dressing laboratory are particularly important for a new mining project or for one that is being reorganized and expanded. A large mine will require power plant, headgear and winder, bins, conveyors, pumps, crushing, grinding and screening machinery, and mineral separation equipment. Although the cost of the separation equipment may not be a major item, this part of the plant is the key to the whole project. If the recovery of the valuable mineral should be too low, the entire plant would be an economic failure; if the grade of the product should not meet market requirements, there would be no revenue. The function of the laboratory is to find a process or combination of processes giving an adequate recovery of a product that will meet market specifications or the demands of a smelter. If the laboratory work is successful, plant layout and design can follow.

The new laboratory at Erith is self-contained, and it will ultimately have a staff of seven, of whom four will be university graduates. The original laboratory at Wembley was set up for flotation work and simple gravity concentration, but it has grown to such an extent that practically all ore treatment and coal preparation processes can now be carried out. In addition to the testing work outlined above, there will be a continuous development programme for new machines and processes.

Equipment

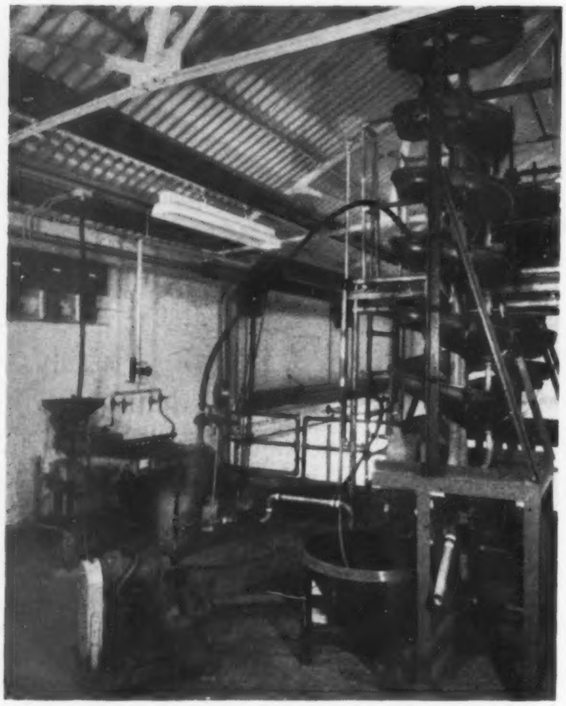
In the laboratory, primary crushing is performed in a jaw crusher which can take 2 in. pieces. If a large batch has to be broken down, the product from the crusher can be discharged into a Sherwen spiral conveyor in which it is elevated to a Sherwen screen, crushing and screening being completed in a single operation. Secondary crushing can be carried out with rolls if desired, but, as the jaw crusher is comparatively small, it can easily make a product suitable for ball or rod mill feed, and so rolls are seldom used. Batches of ore are handled in standard steel pans by means of a Slingsby pan truck and a hydraulic lifting device. A disc grinder is available for fine grinding of assay samples but is not used for preparing ores for treatment.

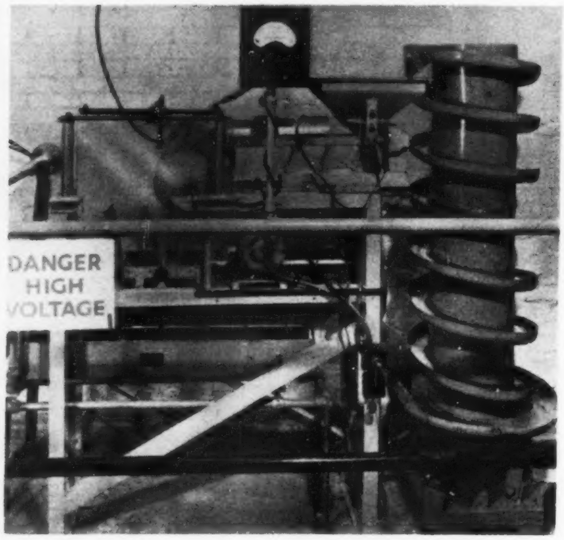
Coarse ore can be treated by heavy-medium separation or in a jig. The H.M.S. machine is a very effective unit with a 20 in. diameter separating cone, a Sherwen screen and a Wilfley pump. Ferrosilicon or magnetite are normally used for making the medium in which separation takes place and a separating density as high as 3·5 can be reached. Feed up to ½ in. in size, and sometimes up to ¾ in., can be treated. The jig unit works well with ¼ in. feed but is too small to take larger material.

Fine ore and coal can be concentrated in Humphreys spirals, on a shaking table or by flotation. The spirals are full-size commercial units which can be run either with a continuous feed or, for relatively small samples, with a batch feed in a closed circuit. The table is a small-scale machine for continuous running, with circulation of middlings if required. Flotation is carried out in batch cells of various sizes.

A wet magnetic separator is available either for treating ores containing

A section of the wet laboratory on the ground floor of the new Mineral Dressing Laboratory, at the Erith Works of The General Electric Co. Ltd. of England





Left: The two Humphreys spirals and the small concentrating table used for the concentration of fine ore and coal

Right: An experimental laboratory-scale high-voltage separator unit

highly magnetic material or for cleaning magnetic media used in the heavy-medium separation machine.

Dry processing can be done in a high-intensity magnetic separator of the cross-belt type or by high-voltage ('electrostatic') separation in a laboratory-size unit, both machines being capable of continuous operation.

Preparation of ores for processing can be carried out by grinding and classification. Laboratory grinding procedure has been developed to a stage of high efficiency. It can be carried out in batch or continuous mills, with either balls or rods, in open or closed circuit. A special hydraulic classifier has been developed which can be used either for batch or continuous sizing and can be incorporated with the grinding unit when closed-circuit operation is required. In addition, a conventional 3 in. cyclone unit is available for classification or desliming either by batch or continuous operation.

A rotary vacuum filter is used for dewatering solids during preparation and separation procedures. It can be used when required for filtration tests. Batch filters are employed for dewatering small samples and ovens are provided for drying the products made during the testing programmes.

Control equipment includes a Rotap sieve shaker and standard sieves, a Haultain superpanner and a Franz magnetic separator. These, used in conjunction with microscopic inspection, X-ray diffraction, and chemical analyses are invaluable for examining new ores and for assessing the results of treatment.

The laboratory is laid out on two floors, one end of the building being for wet work and the other for dry. Offices and balance room are on the upper floor and there is a small workshop on the ground floor. The building has A.C. and D.C. electrical supplies; compressed air comes from the works main and is reduced to any required pressure by a regulator in the laboratory; vacuum, mainly for filtration, is supplied by a wet vacuum pump; water comes from a steady-head tank which eliminates pressure variations.

Much of the laboratory equipment is portable and has been designed for plugging in at any convenient point so that machines can readily be assembled into various combinations, such as a rod or ball mill, classifier, circulating pump and feeder. All equipment is kept ready for use at a moment's notice so that attention can be concentrated on the technical aspects of ore treatment and no time lost in devising ways and means of linking up the various units.

"Oriana's" Aluminium Superstructure

—continued from page 300

Aluminium Company's Rogerstone works. This huge machine, built by Loewy Engineering Co., Ltd., made a significant contribution to the success of the aluminium plate supply.

Similarly important was a 60 ft. plate saw, in use at the same works, capable of cutting plates to a hitherto-unattainable degree of accuracy and with guaranteed edge straightness. By the use of this equipment, it was possible to supply the aluminium plates cut to the exact required widths, thus reducing the amount of shipyard plate trimming work to the minimum.

The general thickness of the plates supplied was from 0·2 to 0·4 in., with a small number of thicker plates. All were of aluminium alloy to the B.S. NP5/6 specification, meeting the requirements of Lloyd's Register for welded ship structures.

As far as possible, extruded aluminium alloy sections were used in the *Oriana's* superstructure for girders and other members, as well as for the usual deck beams and stiffeners, rather than members fabricated from plate. This has meant that the proportion of extruded sections in the structure is higher than is usually the case in work of this kind.

The sections throughout were of aluminium alloy to the B.S. NE6 specification (MG5 supplied by James Booth & Co., Ltd.). Some unusually large extrusions were included, up to 16 in. in overall dimension and with a weight per ft. of over 15 lb. For beams and stiffeners incorporated in the prefabricated deckhouse panels, a special series of sections with a tapered bulb was used, as an alternative to the better-known square-bulbed British Standard aluminium shipbuilding sections.

The building of a ship with this 1,000 ton aluminium superstructure—incidentally, by far the largest welded aluminium structure ever built—clearly demonstrates the great progress that has been made in the development of sound techniques for the employment of welded aluminium in shipbuilding. Less than ten years ago, a shipyard application of aluminium on the scale of that in the *Oriana* would have hardly been predictable.

Industrial News *Home and Overseas*

Change of Address

As a result of the steadily increasing demand for aeration, filtration and fluidizing equipment, **Aerox Limited** have outgrown their premises at Crawley and have now acquired a much larger factory for their engineering section.

This new factory is at Chalford, Stroud, Gloucestershire, and the increased floor space now made available will enable the company to handle an even greater volume of work.

Heating and Welding

It is announced that the Metropolitan-Vickers Heating and Welding Department has been made an integral part of the **A.E.I. Transformer Division.** The business of the department will continue to be managed by a departmental group committee, consisting of Mr. G. H. Moule, chief engineer; Mr. H. S. Carter, sales manager, and Mr. T. R. Parter, superintendent, manufacture.

Glasgow Expansion

News from **Hugh Smith and Co. (Possil) Ltd.** is that they have completed a £400,000 extension to their plant engaged on marine machine tool production. The extension includes a new milling and fabrication bay, a materials handling bay, a new drawing office, and other facilities. The development has been necessitated by the demand for larger machine tools to meet the larger fabrication work on modern ships.

Annual Meeting

Readers are reminded that the annual general meeting of the **Institute of Metal Finishing** is to be held at the Charing Cross Hotel, London, on Monday, November 30, commencing at 11 a.m. Following this meeting the luncheon will be held.

At 2.45 p.m. the meeting will be resumed when the new President, **Mr. A. A. B. Harvey,** M.Sc., F.R.I.C., will be inducted by the retiring President, Dr. T. P. Hoar. The new President will then deliver his address on "The Role of the Scientific Society".

Aluminium Alloy Boats

A new approach to aluminium alloy runabouts was demonstrated last week on a lake in Essex when members of the Press, at the invitation of the **British Aluminium Company Limited**, were invited to inspect and handle two types of aluminium alloy boats which have been designed jointly by Folland Aircraft Limited and the British Aluminium Company.

The two types shown were the "Terrapin", an extremely well-finished runabout, and the "Trollboat", a simplified design for fishing purposes. Both versions have similar dimensions— 13 ft. 6 in. long with a maximum beam width of 5 ft. 1 in.—the differences being in the equipment and furnishings provided. Both boats can be driven by outboard motors of between 5 and 35 h.p. clamped to the transom. With a 35 h.p. motor, the "Terrapin" on trials has achieved a speed of over 32 m.p.h., and with a 16 h.p. motor about 18 m.p.h. is possible. The manoeuvrability of both boats is excellent, and full helm can safely be applied with fully open throttle, the boat remaining "dry" under average conditions.

The design has used to full advantage the skin stretching equipment developed for aircraft construction, and this has resulted in a hull of pleasing lines possessing the strength conferred by a double-curvature 16 S.W.G. aluminium alloy skin. This is believed to be the first occasion in this country that stretched skins have been used in the construction of a boat. One of the many advantages of this method of construction is that it is possible to incorporate rounded bilges, without joints, in a metal boat.

Other manufacturing techniques used in the aircraft industry which have been employed in the construction of the Folland boats include the Alocrom process for the undercoat, which provides an excellent and durable base for the final coat, which is an epoxy resin finish.

The double curvature skin is stretched in 16 S.W.G. BA.25W aluminium alloy sheet, an age-hardening material, and the frames and other structural components are formed in BA.21. The two half hulls are joined along the length of the keel by single rows of rivets on to an extrusion with shrouded lips, Boscoprene sealing providing a perfect and lasting joint. All rivets are milled flush. Our photograph on this page shows the "Terrapin", with Perkins 35 h.p. engine, under way.

Tunnel Kilns

An extension to their range of small, special purpose high-temperature tunnel kilns for the electronics, ceramic and other industries has been introduced by the Allied Engineering Division of **Ferro Enamels Ltd.** These kilns are available in a range of sizes from 15 ft. to 60 ft., and in all temperature ranges from 800°C. to 1,400°C., and are of the sliding-plate tunnel type. This is a supplementary range to that of the small special-purpose car-type tunnel kilns which is now available in the temperature range of 800°C. to 1,600°C. Both types are electrically fired.

Half-Yearly Meeting

It is announced by the **National Association of Non-Ferrous Scrap Metal Merchants** that their half-yearly general meeting will be held at the Midland Hotel, Birmingham, on Wednesday, December 2 next, commencing at 2.45 p.m. Prior to the meeting a luncheon will be held, tickets for which, price £1 7s. 0d., may be obtained on application to the secretary of the Association.

Annual Function

Advance notice is given of the annual dinner-dance of **The Non-Ferrous Club,** which is to be held at Chadwick Manor Hotel, Birmingham, on Thursday, December 3, commencing at 7.30 p.m. Tickets, price two guineas each, may be obtained from Mr. H. A. McGhee, 33a Powell Street, Birmingham, 1.

Bronze and Brass Ingot Makers

At Grosvenor House, London, last Saturday, the annual dinner-dance of the **British Bronze and Brass Ingot Manufacturers' Association** was held. The inclement weather in the London district kept away some who would otherwise have attended, but there was a large and enthusiastic gathering of members and their friends.

The dinner was under the chairmanship of **Mr. James H. Barwell,** J.P., President of the Association, who, after the Loyal Toast had been honoured, proposed the toast of "Our Guests and the Ladies". Response to this was made by Mr. Leonard H. Cleaver, J.P., M.P., who, in the course of his remarks, said:

"Bronze is an ancient metal with an historic past, and the bronze and brass industry has served the country well for many years. But times change, and we are now living in the sputnic world which challenges the complacency of the past. This is a time when new alloys are required and when new uses must be found for the older types of metal. This naturally involves two things. First, there must be co-operation between supplier and customer in finding new markets for the products of the industry. At the same time, considerable sums must be spent on research, without which the industry might wither and die. The Free Trade Area (large or small) presents a challenge to the ingot manufacturers and it is, therefore, essential that the industry should be properly represented and have the appropriate information to present at the vital time to Government Departments."

The evening concluded with dancing to Sydney Lipton's ballroom orchestra.

The "Terrapin" aluminium alloy boat

The delegates to the 3rd biennial Efco-Udylite Distributors' Conference at Weybridge, on October 7-9, included (left to right): Mr. H. Silman, Electro-Chemical Engineering Co. Ltd.; Mr. J. H. Gifford, Electro-Chemical Engineering Co. Ltd.; Mr. G. Jonsson, A. B. Tudor, Sweden; Dr. A. Hoch, Friedr. Blasberg, Germany; Mr. L. K. Lindahl, Udylite Corp., U.S.A.; Mr. D. R. Newman, Electro-Chemical Engineering Co. Ltd.

Distributors' Conference

Twenty-three delegates from twelve European countries were present at the third biennial Efco-Udylite Distributors' Conference, which took place at Weybridge, in Surrey, under the auspices of the **Electro-Chemical Engineering Co. Ltd.**

Efco-Udylite Distributors are independent companies supplying and servicing Udylite automatic electroplating plant and processes throughout Europe and the British Commonwealth, working closely with the Udylite Corporation of Detroit. Mr. L. K. Lindahl, chairman of the Udylite Corporation, and Dr. H. Brown, director of research of the Udylite Research Corporation, were present at the conference, which was primarily concerned with technical matters, and at which some fifteen Papers were given.

Trade with Russia

On the eve of the departure of the delegation of the **Scientific Instrument Manufacturers' Association of Great Britain** for a visit to the U.S.S.R., Mr. L. A. Woodhead, President of the Association, in a statement to the Press, said that our recent trade with the U.S.S.R. in the field of scientific instruments manufactured in Great Britain had led us to believe that a far more substantial business could be built up. The Russians themselves like the quality and special, often unique, scope of British instruments. It was this fact which led the All Union Chamber of Commerce in Moscow to invite the British association to send a delegation to explore the possibilities for an exhibition of British scientific instruments, supported by special demonstrations and lectures by specialists on their use and future development in certain fields.

Course of Lectures

A course of lectures on "Virgin and Scrap Non-Ferrous Metals", to be held at the City of London College, has been arranged by the **National Association of Non-Ferrous Scrap Metal Merchants.**

This is not described as a technical course, but one which has been designed to give an opportunity to the staff of scrap metal firms to gain a general picture of the trade in which they are engaged. The syllabus covers eleven lectures and demonstrations. The subjects are as follows: — Origin of principal base metals; Copper and copper-base alloys; Light alloys; Non-ferrous scrap and residues; Commercial practice in the non-ferrous scrap metal trade; Brass and copper rolling; Tin, lead, zinc, nickel and their alloys; Refining of scrap metals and residues; Foundry work; Sampling; Metal markets.

The lectures will be given on Thursdays from 6 to 7.30 p.m., commencing on January 14, 1960. The fee for the course is £1 15s. 0d. The libraries, refectories and full student facilities at the College will be available to all course members.

Trade with Guinea

It has been announced by the Board of Trade that a trade agreement for the 12 months from November 1, 1959, has been negotiated between the U.K. and the Republic of Guinea, and was signed in Conakry last month. Quotas for the U.K. cover the whole range of trade and provide increased facilities for U.K. exports. Guinean exports to the United Kingdom will continue to benefit from trade liberalization measures.

Particulars of quotas for the U.K. exports may be obtained by interested exporters from the Commercial Relations and Exports Dept., Board of Trade, Room 4142, Horse Guards Avenue, London, S.W.1.

Marking Inks

News from **Brent Chemical Products Ltd.** is that the company has now collaborated with Rolls-Royce Ltd. in producing a new marking ink known as Ardrox No. 381, for which the company claims two unique features:

(a) It is applied in the form of self-spraying Aerosol dispensers, which means that a thin even coating is obtained over the entire surface, and (b) after "marking off" has been completed and it is desired to remove the residues of the ink, this removal can be readily achieved merely by immersing the components in a liquid or vaporized trichloroethylene.

Alloy Gives Big Weight Reduction

Extensive use of Duralumin alloy in a new fixed sided end tipping body by the Duramin Engineering Co. Ltd., enabled Westonia Garage Ltd. to produce a heavy duty tipping body based on the Dodge Seven Ton short wheelbase chassis with a total weight just below the four-ton mark. The body is mounted on the versatile Dodge 3144Y chassis, and cab fitted with Edbro W.3 tipping gear and steel sub-frame, and powered by the Dodge 351 in^3 (5·76 litre) six cylinder diesel engine.

The Duramin tipping body, especially developed for the chassis, has a total capacity of 8 yd^3 with slight freeboard, and yet weighs no more than 8 cwt. 2 qr. Internal dimensions are 13 ft. 6 in. long × 6 ft. 11 in. wide, with sides 3 ft. high above floor level. It is strongly framed in Duralumin, with a floor of ¼ in. thick Duralumin plate riveted to the channel cross bearers with additional channel members placed lengthwise down the centre and two additional "T" section stiffeners fitted between the bearers. The fixed sides are similarly framed and panelled with the alloy sheeting. So is the front end, which incorporates a canopy extending 18 in. forward to protect the rear of the cab. Special locking gear automatically takes up wear and prevents rattle.

Safety in Industry

It is reported that a new organization has recently been formed under the title of **The Industrial Safety (Personal Equipment) Manufacturers' Association,** whose object is to study ways of improving the effectiveness of present types of equipment and of developing others to meet the hazards arising from new industrial processes.

Some three dozen of the existing manufacturers of such equipment have joined this association, and it is hoped to work in conjunction with Government departments, trade unions and national safety organizations, as well as hospitals and the medical profession. It is also intended to provide an information service for industrial safety and welfare officers.

For Scrap Baling

A new mechanical handling development has been introduced by **Portable Balers Limited** in the form of the "Portable", which is suitable for the baling of most kinds of scrap, including metals. One of the features of this new device is that you can wheel the complete baler easily on its truck wheels. It takes up only 8 ft^2 of floor space when not in use, and additional truck fronts can be supplied where desired to speed up disposal of bales under continuous use.

South African Production

According to figures issued by the Government Mining Engineer, South Africa produced 71,282 tons of chrome ore in September this year, against 64,872 tons in August. Manganese production in September totalled 93,702 tons, against 91,244 tons in August.

U.K. Metal Stocks

Stocks of refined tin in London Metal Exchange official warehouses at the end of last week fell to 7,580 tons, comprising London 4,459, Liverpool 2,961, and Hull 160 tons.

Copper stocks were reduced to 6,807 tons, and comprised London 1,573, Liverpool 3,459, Birmingham 75, Manchester 1,600, and Hull 100 tons.

Boat Show

Advanced notices have been issued of the **National Boat Show,** which is to be held at Earls Court, London, from December 30 next until January 6, 1960. This is the sixth annual show, and there will be over 300 craft displayed. A particular feature of this show will be that the rarely used pool at Earls Court will be filled and, framed in the picturesque setting of an English fishing village, the pool will have its own harbour and surrounding shops.

Exporting to the Middle East

A useful brochure under this title is being published by the Board of Trade, and describes the opportunities which exist for the expansion of British trade with the Middle East. The contents

include sections on the size of the market, general background, its difficulties, the principal markets, etc.

Aluminium in Italy

A new plant for the production of aluminium to meet the Italian domestic market requirements for many years is to be built by the Montecatini Company of Milan. This was announced by the company's board, which met to study the group's performance in the first half of 1959. The board announced that, on the basis of figures at September 30 this year, the present financial year should be considered as being satisfactory.

Italian Copper Statistics

Italian imports of crude copper for smelting and refining in the first eight months of this year amounted to 2,628 metric tons, worth 1,036,518,000 lire, according to the Central Institute of Statistics. Imports of refined copper in slabs, ingots, shot and powder totalled 66,327·3 metric tons, which were valued at 25,802,298,000 lire, of which 11,919·2 metric tons, worth 4,797,975,000 lire were imported temporarily.

Main suppliers were Belgium/Luxembourg, with 1,888·4 metric tons; Britain, with 6,698·2; the Belgian Congo, with 17,409·3; Rhodesia and Nyasaland, with 11,134·8; South Africa, with 2,435·9; Chile, with 11,769·9; and the United States, with 11,956·9 metric tons.

Exports of refined copper in slabs, ingots, shot and powder totalled 112·8 metric tons, valued at 46,083,000 lire. Main destinations were Belgium/Luxembourg, 100 kilos; Greece, 79·9, and Britain, 31·9.

Designing for Die-Casting

One of a series of technical publications, the 32-page booklet issued by Fry's Diecastings Ltd. under the above title attempts to show how the design of pressure die-castings in particular can be altered to give the combination of good properties, low cost and good design. There are also many illustrations showing how these advantages may be obtained. Copies of this booklet may be secured free of charge on application to the company.

New Factory in Peterborough

One of the most recent examples of the application of pressure die-castings is the Perkins range of outboard motors, in a range covering 6 h.p. to 35 h.p. These engines use aluminium die-castings for cylinder blocks, cylinder heads, drive housing; in fact, nearly 90 per cent of the castings used for the 6 h.p. and 35 h.p. motors are pressure die-castings. For example, the cylinder block of the 35 h.p. model is produced from one of the biggest and most complicated pressure dies in this country. Four hydraulically operated cores, mounted radially, are used, and the operation is done at the overall close tolerance of 0·015 in. Accuracy is vital, because water passages and centrifugally-cast iron cylinder liners are all cast in position.

For the production of these motors, **F. Perkins Ltd.**, of Peterborough, have converted an ordnance depot of some 150,000 ft^2 to a modern factory employing about 150 at first, and with a production capacity of 150 motors per 8 hr. shift.

Machines on the cylinder block and crankcase line include Wadkin high-speed milling machines, Archdale milling machines, Archdale four- and single-spindle drilling machines, Pollard four- and single-spindle drilling machines, and Johnson and Excello multi-spindle drilling, boring and tapping machines.

Two Bullows paint spray booths with a Ballard gas-fired paint stove have been installed in the factory. Each motor is given two coats of cellulose-based, modified epoxy resin paint, and is then stoved at 360°F.

A well-equipped metallurgical laboratory is available to sample check all incoming outboard material. There is also a comprehensive engineering set-up, with extensive tank and dynamometer testing facilities, and other development equipment. Attached to the factory are administrative offices, jig and tool design, and planning departments with a production control and general stores, a maintenance section, and a jig and tool maintenance department.

Beryllium Metal

On the evening of Thursday, December 3, there is to be a joint meeting of the Institute of Metals and the Bristol section of the Society of Chemical Industry in the Lecture Theatre of the Department of Chemistry, University of Bristol. At this meeting, Dr. G. A. Wolstenholme will deliver a lecture on "Beryllium Metal: Production, Properties and Applications". The meeting will commence at 6 p.m.

After the lecture there will be an informal dinner in the Senior Common Rooms, at which ladies and other visitors will be welcome. Tickets are obtainable from Dr. Arthur Marsden, 181 Bishop Road, Bishopston, Bristol, 7.

New Branch

A new service to scientific instrument users is being provided by **Griffin and George Ltd.**, who are opening a new branch at 626 Welbeck Road, Walker, Newcastle upon Tyne, on Tuesday next, November 17. To celebrate this event the company is holding two exhibitions in the North.

The first exhibition is to be held at the Heaton Assembly Rooms, Newcastle upon Tyne, from November 17 to 20, and the second will be at the Corporation Hotel, Middlesbrough, from November 23 to 25. At both exhibitions, a representative range of scientific instruments and equipment will be shown, including the latest type for education, research and development, and industry.

West German Aluminium Production

Statistics issued in Düsseldorf show that West Germany produced 110,270 tons of aluminium in the first nine months of this year. This was an increase of 4·7 per cent over the comparable period of last year. Production of aluminium alloys, at 65,411 tons, was 5·2 per cent higher than in the January to September period of 1958.

West German industries making aluminium goods produced 135,920 tons of semi-manufactureds in the first nine months of this year, an increase of 10·2 per cent over the same period of 1958, and 56,730 tons of aluminium castings, an increase of 8·3 per cent.

Neutron Project

A new laboratory came into operation last week at the Atomic Energy Research Establishment, Harwell, which will produce nuclear data of great value for the design of reactors. Extending over a 20-acre field and housing what is probably the most extensive range of neutron time-of-flight spectrometers in the world, the laboratory is under the supervision of the Nuclear Physics Division of A.E.R.E., and was designed to their requirements.

The laboratory is centred on a machine best described as a combination of an accelerator and a reactor. An electronic linear accelerator is used to generate an intense pulsed beam of electrons, which fall upon a mercury target to produce X-rays which, in turn, are directed upon a uranium target to produce neutrons. In this machine the uranium target is itself a sub-critical fast reactor. Without the electrons the reactor is effectively shut down and generates no neutrons. During the pulse, however, the neutrons produced from the electrons stimulate the reactor, which then burns for an instant at the rate of 10 megawatts, and in doing so releases many more neutrons than could have been produced by the electron beam alone. At the end of the pulse, the reactor reverts to its quiescent state. Because of the pulsed nature of the machine, its mean nuclear power output is of the order of only 2½ kilowatts.

The equipment is intended to provide information about the detailed behaviour of neutrons of known velocities when they encounter the materials employed in the construction of reactors. One of the best methods of determining the velocity of a neutron is by a direct timing technique. Neutrons from a pulsed source are allowed to travel down a number of evacuated tubes (flight-tubes) radiating out from the neutron source.

Forthcoming Meetings

November 16 — Institute of British Foundrymen. East Anglian Section. Lecture Hall, Public Library, Ipswich. "Precision Castings." J. S. Turnbull. 7.30 p.m.

November 17—Institution of Production Engineers. Midlands Region. The Cromwell Room, The Grand Hotel, Leicester. "The Sulphinus Process of Heat Treatment." J. C. Gregory. 7.15 p.m.

November 17—Institute of Metal Finishing. South West Branch. Royal Hotel, Cardiff. "Vacuum Coatings." A. Weill. 7.30 p.m.

November 18—Institute of Metal Finishing. London Branch. Festival Hall, London. One-Day Symposium, "Progress in Polishing."

November 18 — Institute of British Foundrymen. Southampton Section. Technical College, St. Mary's Street, Southampton. Joint meeting with the Southampton Metallurgical Society. "Properties of Copper-base Alloy Castings." F. Hudson. 7.30 p.m.

November 19—Institution of Mining and Metallurgy. Rooms of the Geological Society, Burlington House, Piccadilly, London, W.1. General Meeting. 5 p.m.

November 19 — Institute of Metals. Sheffield Local Section. Applied Science Building, The University, St. George's Square, Sheffield. "Primitive Metallurgy." Professor F. C. Thompson. 7.30 p.m.

November 19 — Institution of Plant Engineers. Merseyside and North Wales Branch. Donnan Laboratories, Liverpool University. "Developments in Welding Practice." Dr. R. Weck. 7 p.m.

Metal Market News

GENERALLY speaking, business sentiment was rather more subdued last week, and the tone on the Stock Exchange was slightly reactionary. Nevertheless, the outlook is regarded with optimism and majority opinion is that industrial activity will continue at a good rate into the Spring. Fluctuations were seen in the prices of non-ferrous metals, but on the whole the tone was steady, although zinc lost ground. So far as copper was concerned the week opened with a drop of 1,593 tons in warehouse stocks to 7,857 tons, and although as we write this week's figures are not available, the expectation is that the downward slide will continue. There is probably very little electro now remaining on warrant, the tonnage consisting mainly of fire refined quality. Wirebars are now very scarce, especially for early delivery, and the premium is reported to be in the neighbourhood of £20. Anaconda has raised its selling price to 33 cents, but dealers have been asking 40 cents, and, no doubt, getting it, for copper is now very scarce in the United States. Indeed, it seems as if at last the effect of the prolonged copper strike is now showing itself in terms of a shortage at consumers' plants in America, where hitherto, thanks to the long notice that was given of impending trouble in the copper mining industry, things have kept going pretty well. In fact, up to the present copper has been available, at a price, but now it looks as though even a high quotation is not good enough to keep metal coming forward.

The week opened with a very sharp setback in the London price on the news that the Braden strike had been settled. This, of course, had been expected off and on for some days, but when the event finally occurred a sense of shock was felt by a market which was, perhaps, very fully bought. The drop was a sharp one, £6 10s. 0d. in the cash price and about £3 10s. 0d. for three months, and it could well have been more but for the fall in the warehouse stocks and the report of some unrest in the Congo. For a couple of days the market seemed unsure of itself, but in midweek there was a recovery, and Wednesday saw the afternoon price £4 above Monday's settlement quotation. On the strength of this, the Comex price improved, and with both American and Continental demand in evidence a firm tone prevailed for the remainder of the week. Finally, after a turnover approaching 13,000 tons, cash closed unchanged at £260 and three months £2 higher at £248 10s. 0d. The narrowing of the backwardation was a welcome development, but £11 10s. 0d. is, nevertheless, very onerous. All things considered, it seems as though the price of standard copper were destined to move higher unless the American strike is soon settled.

Business in tin was unusually active last week, the turnover amounting to about 1,400 tons, of which considerably more than a half was put through on Friday last. But for heavy selling by the Buffer Pool, the price must have moved much higher. Stocks fell by 179 tons to 7,671 tons at the beginning of the week. Cash was unchanged and three months £1 up at £794 and £797 10s. 0d. at the close of business. In lead, the turnover was unusually heavy at 9,600 tons, and the trend was definitely upwards in spite of some setback in the second half of the week. On balance, November was £2 10s. 0d. up at £74, and February £1 better at £73 5s. 0d. It will be noted that a backwardation developed. The American price of zinc fell by ½ cent to 12½ cents, and in London values weakened by £4 for prompt and £3 for forward at £94 and £89 15s. 0d. The turnover was about 5,225 tons.

Birmingham

Trading conditions in the Midland area continue active. Order books have been filled again and there is a good market for nearly all grades of non-ferrous metal. Plating firms are busy on work for the motor and cycle trades. There has been a revival in the motor-cycle business during the last few months. The machine tool trade, after a dull spell, is now sharing in revival although there is plenty of room for expansion. Order books in the motor car business are bigger than they have been for a very long time, and there is a substantial output destined for export.

There is increasing pressure for delivery of steel, with the result that delivery dates are being extended for some products. Sheet mills are working to capacity on material for the motor trade. Makers of heavy plates are moderately employed. The re-rolling mills are very busy on sections, bars and strip, and there has been a corresponding increase in the buying of semi-finished steel. The heavy engineering industries are good customers for iron castings. Supplies of pig iron are ample to cover all requirements despite the improvement in foundry business over the last six months.

New York

At the end of last week, copper was firm on active covering and new buying. Physical copper was quite firm, spot selling in a small way at 40 cents, prompt delivery around 39⅞ and December delivery at 39¾. The trading volume was on the moderate side. The tightness in copper may be aggravated by a strike at the Anaconda Raritan refinery unless a new contract can be worked out between the company and the U.S. Steel Workers' Union. Tin was quiet and steady; lead and zinc were quiet.

Importers last week appealed to the U.S. Tariff Commission to reject the request of three U.S. zinc sheet manufacturers for higher tariffs on sheet supplied to the American market by European manufacturers. Mr. Ernest Speier of S. Speier Company, of New York, told the Commission he imported zinc sheet from the Netherlands and West Germany and his was a small business. But, he said, the increase in tariffs asked by the U.S. companies on uncoated zinc sheets, from one cent per lb. to 46·9 per cent ad valorem, would put Speier out of business since imports accounted for 70 per cent of their sales. "They propose not the equalizing of competition by Governmental intervention, but its elimination," Mr. Speier declared.

He also challenged the American companies' contentions on their very low profits and damage to their sales allegedly caused by imports. He quoted quite extensively in his presentation from the opinion by Tariff Commissioners Sutton, Jones and Dowling in the lead and zinc report of last year, and noted that these three had declared then: "Although the domestic . . . zinc industries may ill-advisedly suggest economic Hara-Kiri as a way out of their difficulties, the Government should not knowingly become an accomplice to such an end by misdirection or irrational use of the escape clause".

Mr. H. Stern of Norca Corporation, of New York City, told the Commission he imported zinc sheets from Yugoslavia and supplied just one customer, who had asked his company to find a foreign source of supply. He said his company's imports began in 1956 and had been static at an average total of under 500,000 lb. of sheets a year. He added that 265,000 lb. had entered the country through August this year to meet his company's needs, but the total imports for calendar 1959 would not exceed 500,000 lb. He also backed the pleas of Mr. Speier.

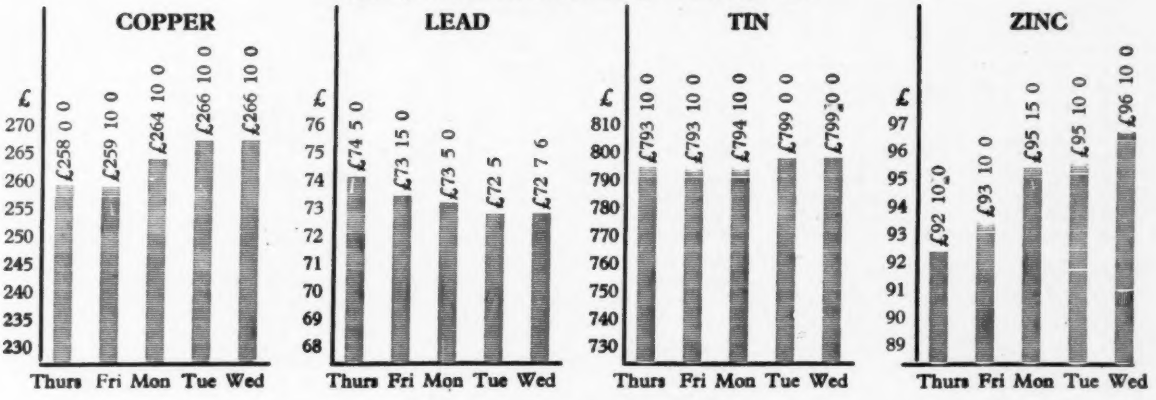
Rome

Imports of scrap copper into Italy in the first nine months of this year amounted to 3,584·9 metric tons, against 5,016·5 metric tons in the same period in 1958, according to the Central Institute of Statistics. Exports of quicksilver are reported to have totalled 802·8 metric tons in the first nine months of this year, compared with 229·2 metric tons in the same period of 1958.

Non-Ferrous Metal Prices

London Metal Exchange

Thursday 5 November to Wednesday 11 November 1959



Primary Metals

All prices quoted are those available at 2 p.m. 11/11/59

		£	s.	d.
Aluminium Ingots	ton	180	0	0
Antimony 99·6%	„	197	0	0
Antimony Metal 99%..	„	190	0	0
Antimony Oxide	„	180	0	
Antimony Sulphide Lump	„	190	0	0
Antimony Sulphide Black Powder........	„	205	0	0
Arsenic	„	400	0	0
Bismuth 99·95%......	lb.		16	0
Cadmium 99·9%	„		9	0
Calcium	„	2	0	0
Cerium 99%	„	16	0	0
Chromium	„		6	11
Cobalt	„		14	0
Columbite.... per unit			—	
Copper H.C. Electro..	ton	266	10	0
Fire Refined 99·70%	„	265	0	0
Fire Refined 99·50%	„	264	0	0

		£	s.	d.
Copper Sulphate	ton	80	0	0
Germanium	grm.		—	
Gold	oz.	12	10	1
Indium	„		10	0
Iridium	„	24	0	0
Lanthanum	grm.		15	0
Lead English	ton	72	7	6
Magnesium Ingots....	lb.		2	3
Notched Bar	„		2	9½
Powder Grade 4	„		6	1
Alloy Ingot, A8 or AZ91	„		2	4
Manganese Metal	ton	245	0	0
Mercury	flask	72	0	0
Molybdenum	lb.	1	10	0
Nickel	ton	600	0	0
F. Shot	lb.		5	5
F. Ingot	„		5	6
Osmium	oz.		nom.	
Osmiridium	„		nom.	

		£	s.	d.
Palladium	oz.	7	5	0
Platinum	„	28	10	0
Rhodium	„	41	0	0
Ruthenium	„	18	0	0
Selenium	lb.		nom.	
Silicon 98%	ton		nom.	
Silver Spot Bars	oz.		6	8¼
Tellurium	lb.		15	0
Tin	ton	799	0	0
***Zinc**				
Electrolytic..........	ton		—	
Min 99·99%	„		—	
Virgin Min 98%	„	93	9	4½
Dust 95/97%	„	126	0	0
Dust 98/99%	„	132	0	0
Granulated 99+% ..	„	118	9	4½
Granulated 99·99+%	„	136	7	6

**Duty and Carriage to customers' works for buyers' account.*

Foreign Quotations

Latest available quotations for non-ferrous metals with approximate sterling equivalents based on current exchange rates

	Belgium fr/kg	≏£/ton	Canada c/lb	≏£/ton	France fr/kg	≏£/ton	Italy lire/kg	≏£/ton	Switzerland fr/kg	≏£/ton	United States c/lb	≏£/ton
Aluminium			22.50	185 17 6	224	168 0	375	221 5	2.50	212 10	26.80	214 10
Antimony 99.0					230	171 10	445	262 10			29.00	232 0
Cadmium					1,300	975 0					130.00	1,040 0
Copper												
Crude												
Wire bars 99.9							500	295 0				
Electrolytic	34.25	252 2 6	30.00	248 0 0	361	270 17 6			3.00	255 0	31.00	248 0
Lead			10.75	88 12 6	103	77 5	165	97 5	.88	74 17 6	13.00	104 0
Magnesium												
Nickel			70.00	578 5	900	675 0	1,200	708 0	7.50	637 10	74.00	592 0
Tin	110.75	817 2 6			1,120	840 0	1,500	885 0	9.75	828 17 6	101.62	812 17 6
Zinc												
Prime western			12.75	105 7 6								
High grade 99.95			13.25	109 5 0								
High grade 99.99			13.75	113 12 0								
Thermic					132.00	99 0 0						
Electrolytic					140.00	105 0 0	209	123 7 6	1.20	102 0	14.00	112 0

Non-Ferrous Metal Prices (continued)

Ingot Metals

All prices quoted are those available at 2 p.m. 11/11/59

Aluminium Alloy (Virgin)

		£	s.	d.
B.S. 1490 L.M.5	ton	210	0	0
B.S. 1490 L.M.6	„	202	0	0
B.S. 1490 L.M.7	„	216	0	0
B.S. 1490 L.M.8	„	203	0	0
B.S. 1490 L.M.9	„	203	0	0
B.S. 1490 L.M.10	„	221	0	0
B.S. 1490 L.M.11	„	215	0	0
B.S. 1490 L.M.12	„	223	0	0
B.S. 1490 L.M.13	„	216	0	0
B.S. 1490 L.M.14	„	224	0	0
B.S. 1490 L.M.15	„	210	0	0
B.S. 1490 L.M.16	„	206	0	0
B.S. 1490 L.M.18	„	203	0	0
B.S. 1490 L.M.22	„	210	0	0

Aluminium Alloys (Secondary)

B.S. 1490 L.M.1	ton	152	0	0
B.S. 1490 L.M.2	„	162	0	0
B.S. 1490 L.M.4	„	178	0	0
B.S. 1490 L.M.6	„	188	0	0

***Aluminium Bronze**

BSS 1400 AB.1	ton	258	0	0
BSS 1400 AB.2	„	268	0	0

***Brass**

		£	s.	d.
BSS 1400-B3 65/35	ton	171	0	0
BSS 249	„	—		
BSS 1400-B6 85/15	„	227	0	0

***Gunmetal**

R.C.H. 3/4% ton	„	—		
(85/5/5/5) LG2	„	215	0	0
(86/7/5/2) LG3	„	225	0	0
(88/10/2/1)	„	267	0	0
(88/10/2/½)	„	280	0	0

***Manganese Bronze**

BSS 1400 HTB1	„	208	0	0
BSS 1400 HTB2	„	220	0	0
BSS 1400 HTB3	„	233	0	0

Nickel Silver

Casting Quality 12%	„	250	0	0
„ „ 16%	„	255	0	0
„ „ 18%	„	275	0	0

***Phosphor Bronze**

B.S. 1400 P.B.1. (A.I.D. released)	„	318	0	0
B.S. 1400 L.P.B.1	„	234	0	0

**Average prices for the last week-end.*

Phosphor Copper

		£	s.	d.
10%	ton	264	0	0
15%	„	266	0	0

Phosphor Tin

5%	„	—		

Silicon Bronze

BSS 1400-SB1	„	275	0	0

Solder, soft, BSS 219

Grade C Tinmans	„	[372	5	0
Grade D Plumbers	„	299	5	0
Grade M	„	408	10	0

Solder, Brazing, BSS 1845

Type 8 (Granulated)	lb.	—		
Type 9	„	—		

Zinc Alloys

B.S.S.1004 Alloy A	ton	129	12	6
B.S.S.1004 Alloy B	„	133	12	6
Sodium-Zinc	lb.		2	8½

Semi-Fabricated Products

Prices vary according to dimensions and quantities. The following are the basis prices for certain specific products.

Aluminium

		£	s.	d.
Sheet 10 S.W.G.	lb.		2	8½
Sheet 18 S.W.G.	„		2	10½
Sheet 24 S.W.G.	„		3	1½
Strip 10 S.W.G.	„		2	8½
Strip 18 S.W.G.	„		2	9½
Strip 24 S.W.G.	„		2	11
Circles 22 S.W.G.	„		3	2½
Circles 18 S.W.G.	„		3	1½
Circles 12 S.W.G.	„		3	0½
Plate as rolled	„		2	8
Sections	„		3	2
Wire 10 S.W.G.	„		2	11½
Tubes 1 in. o.d. 16 S.W.G.	„		4	1

Aluminium Alloys

		£	s.	d.
BS1470. HS10W.				
Sheet 10 S.W.G.	„		3	1
Sheet 18 S.W.G.	„		3	3½
Sheet 24 S.W.G.	„		3	11
Strip 10 S.W.G.	„		3	1
Strip 18 S.W.G.	„		3	2½
Strip 24 S.W.G.	„		3	10½
BS1477. HP30M.				
Plate as rolled	„		2	11
BS1470. HC15WP.				
Sheet 10 S.W.G.	„		3	9½
Sheet 18 S.W.G.	„		4	2
Sheet 24 S.W.G.	„		5	0½
Strip 10 S.W.G.	„		3	10½
Strip 18 S.W.G.	„		4	2
Strip 24 S.W.G.	„		4	9½
BS1477. HPC15WP.				
Plate heat treated	„		6	3½
BS1475. HG10W.				
Wire 10 S.W.G.	„		3	10½
BS1471. HT10WP.				
Tubes 1 in. o.d. 16 S.W.G.	„		5	0½
BS1476. HE10WP.				
Sections	„		3	1½

Brass

		£	s.	d.
Tubes	„		2	1⅞
Brazed Tubes	„		3	3½
Drawn Strip Sections	„		3	3⅞
Sheet	ton	227	5	0
Strip	„	227	5	0
Extruded Bar	lb.		2	2⅞
Extruded Bar (Pure Metal Basis)	„	—		

Brass

		£	s.	d.
Condenser Plate (Yellow Metal)	ton	212	0	0
Condenser Plate (Naval Brass)	„	224	0	0
Wire	lb.		2	10⅞

Beryllium Copper

		£	s.	d.
Strip	„	1	4	11
Rod	„	1	1	6
Wire	„	1	4	9

Copper

		£	s.	d.
Tubes	lb.		2	5¾
Sheet	ton	297	5	0
Strip	„	297	5	0
Plain Plates	„	—		
Locomotive Rods	„	—		
H.C. Wire	„	311	5	0

Cupro Nickel

		£	s.	d.
Tubes 70/30	lb.		3	8⅞

Lead

		£	s.	d.
Pipes (London)	ton	114	15	0
Sheet (London)	„	112	10	0
Tellurium Lead	„	£6 extra		

Nickel Silver

		£	s.	d.
Sheet and Strip 7%	lb.		3	10½
Wire 10%	„		4	5¼

Phosphor Bronze

		£	s.	d.
Wire	„		4	4⅞

Titanium (1,000 lb. lots)

Billet 4½" to 18" dia.	lb.	54/-	55/-
Rod ¼" to 4" dia.	„	95/-	62/-
Wire ·036"-·232" dia.	„	167/-	110/-
Strip ·003" to ·048"	„	200/-	75/-
Sheet 8'×2'. 20 gauge	„	85/-	
Tube, representative average gauge	„	300/-	
Extrusions	„	105/-	

Zinc

		£	s.	d.
Sheet	ton	130	15	0
Strip	„	nom.		

Domestic and Foreign

Merchants' average buying prices delivered, per ton, 10/11/59.

Aluminium

	£
New Cuttings	150
Old Rolled	132
Segregated Turnings	104

Brass

Cuttings	181
Rod Ends	168
Heavy Yellow	135
Light	129
Rolled	171
Collected Scrap	131
Turnings	161

Copper

Wire	243
Firebox, cut up	226
Heavy	224
Light	216
Cuttings	243
Turnings	217
Braziery	180

Gunmetal

	£
Gear Wheels	190
Admiralty	190
Commercial	180
Turnings	175

Lead

Scrap	63

Nickel

Cuttings	—
Anodes	550

Phosphor Bronze

Scrap	180
Turnings	175

Zinc

Remelted	86
Cuttings	72
Old Zinc	51

Financial News

International Nickel

It is reported by the International Nickel Company of Canada Ltd. that its net earnings and those of its subsidiaries for the first nine months of 1959 totalled \$58,222 thousand (U.S.) after all charges, equivalent to \$3·99 per common share. This is compared with \$30,321 thousand or \$2·07 per share in the first nine months of 1958. Net earnings of \$19,831 thousand or \$1·36 per share in the three months ended September 30, 1959, compare with \$8,920 thousand or 61 cents per share in the third quarter of 1958.

The increased earnings this year resulted mainly from the greater demand for nickel and the better price for copper, as well as increased deliveries of platinum, Dr. J. F. Thompson, the chairman, and Mr. H. S. Wingate, the president, said in their remarks to shareholders. Capital expenditure for the whole of 1959 is estimated at \$65 million compared with \$54,444 thousand for 1958.

In a letter to shareholders accompanying the interim report, Dr. Thompson discussed nickel alloy steels, which constitute one of the largest outlets for nickel and will account for an estimated free world consumption of about 60 million lb. of primary nickel in 1959.

Midland Aluminium

Group net profit year to June 30, 1959, £119,337 (£84,058), and dividends 15 (12½) per cent. Fixed assets £476,153 (£461,166), current assets £910,202 (£858,079), and liabilities £629,119 (£694,291).

A Price Reduction

Alcan (U.K.) Limited announce that their price for magnesium ingot, of 99·8 per cent minimum purity is now 2s. per pound delivered at customer's works. This represents a reduction of 3d. per pound from the price current since the beginning of this year.

Metal Traders

Group net profit, year to March 31, 1959, £84,164 (£136,300), and distribution 50 per cent (same). Parent net profit £106,558 (£110,949). Current assets £4,167,598 (£3,115,280), including £268,679 (£393,591) cash, and liabilities £3,067,617 (£1,954,469), including £401,181 (£84,051) bank loans. Capital reserve of parent increased by £72,525 on revaluation of shares in subsidiaries and trade investments.

Wolverhampton Diecasting Co.

Final dividend 20 per cent, making 30 per cent for year to June 30, 1959 (same). Group net profit £93,218 (£85,134) after tax £85,245 (£91,911), loan interest £31,500 (£4,558) and minority interests £106 (£100). Add tax adjustments £243 (£38). Deduct profits tax charge on dividends nil (£14,993). Forward £317,801 (£270,230).

Beralt Tin

The chairman of the Beralt Tin and Wolfram Limited, Mr. F. Gates, said at last week's annual general meeting that the company's prospects looked bright but this depended on the wolfram price remaining at a satisfactory level. It seemed reasonable, despite the intrusion of certain substitutes in recent years, to expect the total demand for wolfram to grow in an expanding world economy. He said that he doubted whether the price level was yet high or steady enough to encourage resumption of productive operations at many of the mines which have had to close down during recent years. The company's reserves of wolfram ore were sufficient to meet any demand likely to be made upon them. He said, apart from Government stocks, the underlying basis of the wolfram market was sounder now than it was two years ago, when much larger commercial stocks were overhanging the market.

Birkett, Billington and Newton

Final dividend 10 per cent, making 12½ per cent for year to July 31, 1959 (same). Trading profit, etc., £54,240 (£65,721). Net profit £18,717 (£19,476), after tax £9,631 (£20,764). Forward £47,107 (£50,692).

Denmark

A Bill removing most of the remaining controls on imports into Denmark from the O.E.E.C. area and the dollar plus some other countries by March 1, 1960, was presented to the Lower House this week by Commerce Minister Kjeld Philip.

Scrap Metal Prices

The figures in brackets give the English equivalents in £1 per ton:—

France (francs per kilo):

Electrolytic copper scrap	(£217.2.6)	280
Heavy copper	(£217.2.6)	280
No. 1 copper wire	(£202.10.0)	260
Brass rod ends	(£146.2.6)	190
Zinc castings	(£57.12.6)	85
Lead	(£69.0.0)	92
Aluminium	(£135.0.0)	180

Italy (lire per kilo):

Aluminium soft sheet clippings (new)	(£200.15.0)	340
Lead, soft, first quality	(£126.0.0)	135
Lead, battery plates	(£45.0.0)	76
Copper, first grade	(£234.0.0)	400
Bronze, commercial gunmetal	(£188.17.6)	320
Brass, heavy	(£162.5.0)	275
Brass, light	(£147.12.6)	250
Brass, bar turnings	(£151.10.0)	260
Old zinc	(£56.0.0)	95

Japan (Yen per metric ton):

Electrolytic copper	(£—)	318,000
Copper wire No. 1	(£—)	290,000
Copper wire No. 2	(£—)	245,000
Heavy copper	(£—)	280,000
Light copper	(£—)	235,000
Brass, new cuttings	(£—)	207,000
Red brass scrap	(£—)	223,000

West Germany (D-marks per 100 kilos):

Used copper wire	(£223.7.0)	255
Heavy copper	(£219.0.0)	250
Light copper	(£188.7.6)	215
Heavy brass	(£131.10.0)	150
Light brass	(£97.5.0)	111
Soft lead scrap	(£59.17.6)	68
Zinc scrap	(£48.2.6)	55
Used aluminium unsorted	(£105.2.6)	120

Trade Publications

Metal Finishing.—W. Canning and Co. Limited, Great Hampton Street, Birmingham, 18.

This company has introduced the first three of a series of news sheets designed to present to the trade new developments in plating and polishing. The first sheet describes the "S" process for chemical brightening of aluminium. The second sheet relates to a new product, a chrome neutralizer which should be of considerable interest to all chromium platers, and the third sheet introduces a new single dip process for bright passivation of bright zinc plated components.

Rotary Dryers.—Head, Wrightson and Co. Limited, Ship House, 20 Buckingham Gate, London, S.W.1.

A 28-page brochure describing and illustrating the range of rotary dryers produced by the Head Wrightson Stockton Forge Ltd., has just been issued. Seven distinct types of Ruggles-Coles rotary dryers are now available, as well as Ruggles-Coles rotary kilns and coolers, each embodying the latest developments in design, fabrication and metallurgy.

Solderless Fittings. — Benton and Stone Limited, Aston Brook Street, Birmingham, 4.

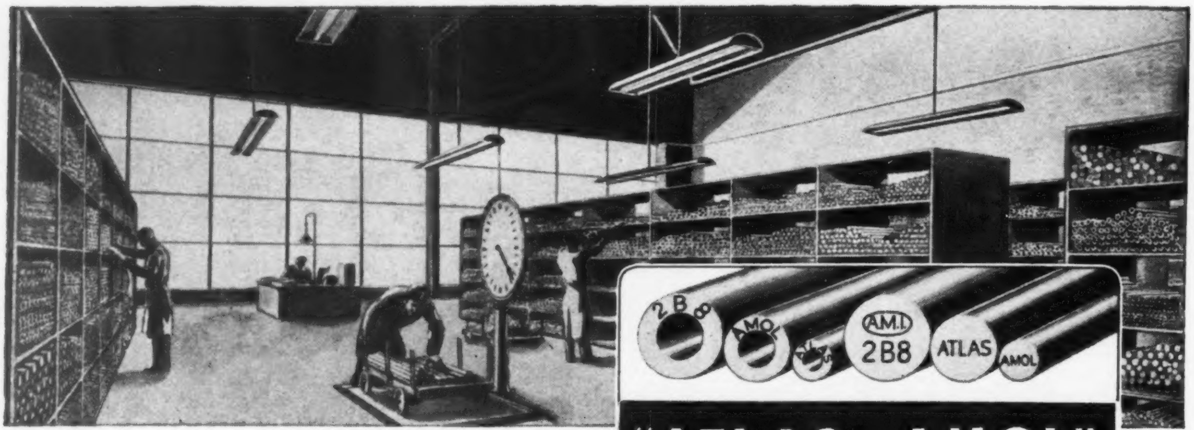
A useful sheet detailing the additions which this company has made to their range of solderless pipe fittings has been issued. Sizes, prices and reference numbers are given of the extensive range.

THE STOCK EXCHANGE

Undertone Firm. Turnover Not Quite So Heavy

ISSUED CAPITAL ●	AMOUNT OF SHARE	NAME OF COMPANY	MIDDLE PRICE 9 NOVEMBER	+RISE — FALL	DIV. FOR LAST FIN. YEAR	DIV. FOR PREV. YEAR	DIV. YIELD	1959 HIGH	1959 LOW	1958 HIGH	1958 LOW
£	£				Per cent	Per cent					
4,435,792	1	Amalgamated Metal Corporation ...	32/3		9	9	5 11 6	32/3	23/3	24/9	17/6
400,000	2/–	Anti-Attrition Metal	1/3		4	8½	6 15 0	1/6	1/3	1/9	1/3
41,303,829	Stk. (£1)	Associated Electrical Industries ...	63/6	—1/3	15	15	4 14 6	67/–	54/–	58/9	46/6
1,613,280	1	Birfield	69/6	+6d.	15	15	4 6 3	75/–	46/9	62/4½	46/3
3,196,667	1	Birmid Industries	99/–	—6/–	17½	17½	3 10 9	108/9	72/–	77/6	55/3
5,630,344	Stk. (£1)	Birmingham Small Arms	60/–	—3/–	12½	11	4 3 3	63/3	36/1½	39/–	23/9
203,150	Stk. (£1)	Ditto Cum. A. Pref. 5%	15/9		5	5	6 7 0	16/3	15/–	16/1½	14/7½
350,580	Stk. (£1)	Ditto Cum. B. Pref. 6%	18/7½		6	6	6 8 9	18/10½	17/9	17/4½	16/6
500,000	1	Bolton (Thos.) & Sons	45/–	+5/–	10	10	4 9 0	45/–	27/6	28/9	24/–
300,000	1	Ditto Pref. 5%	15/–		5	5	6 13 3	15/6	14/–	16/–	15/–
160,000	1	Booth (James) & Co. Cum. Pref. 7%	20/6		7	7	6 16 6	20/6	20/–	20/4½	19/–
1,500,000	Stk. (£1)	British Aluminium Co. Pref. 6% ...	19/9		6	6	6 1 6	20/7½	18/9	20/–	18/4½
17,247,070	Stk. (£1)	British Insulated Callender's Cables	52/6	—1/6	12½	12½	4 15 3	61/–	46/3	52/6	38/9
17,047,166	Stk. (£1)	British Oxygen Co. Ltd., Ord. ...	76/9	—2/3	10	10	2 12 0	79/–	49/3	52/–	28/3
1,200,000	Stk. (5/–)	Canning (W.) & Co.	16/–		25+ *2½C‡	25	3 18 0	16/–	12/3	25/3	19/3
60,484	1/–	Carr (Chas.)	2/–		12½	25	6 5 0	2/10½	1/3	2/3	1/4½
555,000	1	Clifford (Chas.) Ltd.	26/6	+3d.	10	10	7 11 0	27/–	22/6	22/–	16/–
45,000	1	Ditto Cum. Pref. 6%	16/9		6	6	7 3 3	17/–	15/3	16/–	15/–
250,000	2/–	Coley Metals	3/6		15	20	8 11 6	4/–	2/10½	4/6	2/6
10,185,696	1	Cons. Zinc Corp.†	74/–	—6d.	15	18¾	4 1 0	75/9	59/–	65/3	41/–
1,509,528	1	Davy & United	103/6	+5/–	30‡	20	2 18 0	103/6	43/1½	87/–	45/9
6,840,000	5/–	Delta Metal	21/6	—6d.	31‡	30	3 12 9	22/–	12/–	25/–	17/7½
5 296,550	Stk. (£1)	Enfield Rolling Mills Ltd.	58/6	—1/6	15	12½	5 2 6	60/–	36/7½	38/–	22/9
750,000	1	Evered & Co.	36/9	+1/–	10§	15D	5 8 9	36/9	30/–	30/–	26/–
18,000,000	Stk. (£1)	General Electric Co.	42/9	—1/–	10	10P	4 13 6	48/9	30/–	40/6	29/6
1,500,000	Stk. (10/–)	General Refractories Ltd.	45/3		20	20	4 8 6	45/3	31/9	39/3	27/3
401,240	1	Gibbons (Dudley) Ltd.	67/–		16½	15	4 18 6	67/–	63/–	67/6	61/–
750,000	5/–	Glacier Metal Co. Ltd.	10/3	+9d.	11½	11½	5 12 3	10/3	6/7½	8/3	5/–
1,750,000	5/	Glynwed Tubes	25/9		20 ¶	20	3 2 3	26/–	16/4½	18/1½	12/10½
5,421,049	10/–	Goodlass Wall & Lead Industries ...	47/–	—2/6	13‖	18D	2 15 3	49/6	28/7½	30/9	17/3
342,195	1	Greenwood & Batley	110/–		30	20	5 9 0	110/–	75/–	57/9	45/–
396,000	5/–	Harrison (B'ham) Ord.	25/6	+3d.	*17½	*15	3 8 6	25/6	14/11½	15/9	11/6
150,000	1	Ditto Cum. Pref. 7%	19/6		7	7	7 3 6	19/6	19/3	19/9	18/4½
1,075,167	5/–	Heenan Group	15/–	+3d.	15	10	5 0 0	15/–	7/6	9/7½	6/9
246,209,422	Stk. (£1)	Imperial Chemical Industries ...	54/–	—9d.	12 DZ	10	2 19 3	56/6	33/9	38/–	24/3
34,736,773	Stk. (£1)	Ditto Cum. Pref. 5%	18/9		5	5	5 6 9	18/9	16/–	17/1½	16/–
14,584,025	**	International Nickel	179	+1	$3	$2.60	3 0 6	187¾	154½	169	132¾
300,000	1	Johnson, Matthey & Co. Cum. Pref. 5%	16/3		5	5	6 3 0	16/3	15/4½	16/9	15/–
6,000,000	1	Ditto Ord.	47/9	+6d.	12D	10	3 7 0	47/9	29/7½	47/–	36/6
600,000	10/–	Keith, Blackman	31/3		17½E	15	4 7 0	31/3	25/–	28/9	15/–
320,000	4/–	London Aluminium	7/3	+3d.	10	10	5 10 3	8/3	5/3	6/–	3/–
765,012	1	McKechnie Brothers Ord.	61/3	—2/6	15	15	4 18 0	63/9	41/–	45/–	32/–
1,530,024	1	Ditto A Ord.	60/–	—2/–	15	15	5 0 0	62/–	38/9	45/–	30/–
1,108,268	5/–	Manganese Bronze & Brass	18/6		20§	20	5 12 6	18/6	13/9	14/1½	8/9
50,628	6/–	Ditto (7½% N.C. Pref.)	6/–		7½	7½	7 10 0	—	—	6/3	5/6
13,098,855	Stk. (£1)	Metal Box	75/3	—9d.	11	11	2 18 6	80/–	44/7½	73/3	40/6
415,760	Stk. (2/–)	Metal Traders	11/–	—6d.	50	50	9 1 9	12/3	8/4½	9/–	6/3
160,000	1	Mint (The) Birmingham	31/6	+1/6	10	10	6 7 0	31/6	22/–	22/9	19/–
80,000	5	Ditto Pref. 6%	80/–		6	6	7 10 0	75/6	69/–	83/6	69/–
5,187,938	Stk. (£1)	Morgan Crucible A	49/6xcap		10φ	10	2 17 9	49/6	43/6	45/–	34/–
1,000,000	Stk. (£1)	Ditto 5½% Cum. 1st Pref. ...	18/6	+6d.	5½	5½	5 19 0	18/6	17/6	18/–	17/–
2,200,000	Stk. (£1)	Murex	57/–	—3/9	15	17½	5 5 3	60/9	41/–	58/9	46/–
468,000	5/–	Ratcliffs (Great Bridge)	13/–	+3d.	10R	10	2 17 9	13/–	9/6	11/1½	6/10½
234,960	10/–	Sanderson Bros. & Newbould ...	55/–	+6d.	25	20	4 11 0	55/–	27/9	27/3	24/6
1,365,000	Stk. (5/–)	Sarck	29/6	—9d.	17½GB	15	2 19 3	30/3	18/–	18/7½	11/–
6,698,586	Stk. (£1)	Stone-Platt Industries	62/–	—1/–	15	15	4 16 9	63/–	42/6	45/6	22/6
2,928,963	Stk. (£1)	Ditto 5½% Cum. Pref.	18/3		5½	5½	6 0 6	18/3	15/10½	16/3	12/7½
18,255,218	Stk. (£1)	Tube Investments Ord.	117/6	+6d.	17½	15	2 19 9	120/–	72/–	86/–	48/4½
41,000,000	Stk. (£1)	Vickers	30/3	—1/6	10	10	6 12 3	37/–	27/4½	36/3	28/9
750,000	Stk. (£1)	Ditto Pref. 5%	15/–		5	5	6 13 9	15/0¾	14/3	15/9	14/3
6,863,807	Stk. (£1)	Ditto Pref. 5% tax free	23/–		*5	*5	6 9 6A	23/–	20/6	23/–	21/3
2,200,000	1	Ward (Thos. W.), Ord.	143/9	+2/6	20	15	2 15 9	147/6	83/–	87/3	70/9
2,666,034	Stk. (£1)	Westinghouse Brake	52/9	+6d.	10	10	3 16 0	53/9	39/9	46/6	32/6
225,000	2/–	Wolverhampton Die-Casting ...	11/9	—10½d.	30	30	5 2 3	13/3	8/8¾	10/1½	7/–
591,000	5/–	Wolverhampton Metal	31/–	+1/–	27½	27½	4 8 9	32/6	21/6	22/9	14/9
78,465	2/6	Wright, Bindley & Gell	7/–	—1½d.	20	20	7 2 9	7/6	4/11½	5/4½	2/9
124,140	1	Ditto Cum. Pref. 6%	13/9		6	6	8 14 9	13/9	12/10½	13/–	11/3
150,000	1/–	Zinc Alloy Rust Proof	3/6	+3d.	27	40D	7 14 3	3/9¾	2/9	3/1½	2/7½

*Dividend paid free of Income Tax. †Incorporating Zinc Corpn. & Imperial Smelting. **Shares of no Par Value. ‡ and 100% capitalized issue. ●The figures given relate to the issue quoted in the third column. A Calculated on £7 8 9 gross. Y Calculated on 11½% dividend. ‖Adjusted to allow for capitalization issue. D And 50% capitalized issue. C Paid out of Capital Profits. E and 50% capitalized issue in 7% 2nd Pref. Shares. § And Special distribution of 2½% free of tax. R And 33⅓% capitalized issue in 8% Maximum Ordinary 5/– Stock Units. ¶ Interim since increased from 10% to 12%. φ And 40% capitalized issue. Z Interim since increased. B And proposed 50% capitalized issue. G And 1¾d. special distribution.



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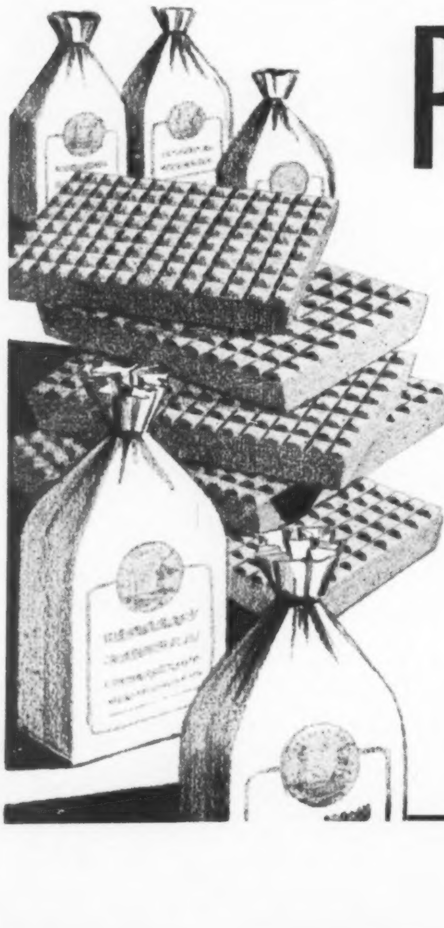

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EXPERIENCED Production Manager required for centrifugal non-ferrous foundry. Must be experienced Manager and/or Technician, and preferably have experience of centrifugal casting process. Reply in confidence to Managing Director, Metals & Alloys (Birmingham) Limited, Forge Lane, Minworth, Sutton Coldfield. [7898

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(Development and Engineering Group Headquarters),
Risley, Warrington, Lancashire.
Closing Date: 23rd November, 1959.

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